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NAVY (EDUCATION).

REPORTS
OF THE
COMMITTEE APPOINTED TO ENQUIRE
INTO THE EDUCATION AND TRAINING OF CADETS
MIDSHIPMEN AND JUNIOR OFFICERS,
OF HIS MAJESTY'S FLEET;
TOGETHER WITH
ENCLOSURES.

Presented to Parliament by Command of His Majesty.



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NAVY (EDUCATION).

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1913.

COMMITTEE ON EDUCATION AND TRAINING OF NAVAL OFFICERS.

N O T E.

The decision of the Board of Admiralty on the recommendations of the Committee will be embodied in a Circular Letter to the Fleet which will be issued in due course.

TERMS OF REFERENCE.

In order to give full effect to the policy of Naval Training instituted in 1902, and, while adhering closely to the principle underlying that policy, to consider and report on :—

A.

The training and education of naval officers of the military branch from the time of leaving Dartmouth College, including :—

- (1) The regulations and procedure to be applied to the period between the date of a cadet leaving Dartmouth College and the date of his examination for the rank of lieutenant, with special reference to—
 - (a) Whether cadets should go to a training cruiser before joining the fleet.
 - (b) Age at which the midshipmen should become sublieutenants, and length of service as midshipmen,
 - (c) Naval instructors.
- (2) The conduct of, and syllabus for, the examination for the rank of lieutenant with special reference to—
 - (a) Voluntary subjects.
 - (b) The awards to be made under the examination.
- (3) The regulations to govern subsequent training and specialisation, with special reference to engine-room duty.

B.

The education, including courses of instruction, and system of examination, at present given at Osborne and Dartmouth Colleges, with special reference to—

- (a) Age of entry at Osborne College ;
- (b) Length of time spent at Osborne and Dartmouth ;
- (c) Should Osborne be rebuilt, or a new site selected in view of probable increase in numbers required.*

C.

The arrangements required to provide the engineering staff for special employment, e.g., at the Admiralty, in H.M. Dockyards, &c.

* This question is being dealt with in a supplementary report still under consideration and is not included in this publication.

Summary of Main Recommendations in Reply to the Terms of Reference.

Taking each item of the Terms of Reference the recommendations of the Committee provide:—

A.

(1) Regulations for training at sea, prepared on the principle that officers should learn their work by taking part in the daily work of the ship (page 126):—

(a) That cadets shall continue to go to a cruiser before joining the fleet, but in January 1915 the time allotted will be reduced from eight months to four, (paragraph 16, Third Report, page 24).

Revised regulations for the training in the cruiser which have been already submitted, approved and acted on (Second Report and enclosure 13 to Third Report, page 101).

(b) That the age on becoming acting sublieutenant shall remain as at present viz., $19\frac{1}{2}$ —20, until September 1917 when it shall be reduced to $19\frac{1}{2}$ — $19\frac{8}{12}$.

The age on promotion to sublieutenant will vary between $20\frac{1}{2}$ —21 until November 1913 when it will become $20\frac{1}{2}$ — $20\frac{1}{2}$; in March 1918 it will be further reduced to $19\frac{1}{2}$ — $20\frac{1}{2}$.

The length of service as midshipman will continue to be $2\frac{1}{2}$ years and that as acting sublieutenant will vary between $\frac{8}{2}$ and 1 year until November 1913 when it will become $\frac{6}{2}$ to $\frac{9}{2}$ year (paragraph 36, Third Report, page 30).

(c) That naval instructors shall be removed from all seagoing ships, except the training cruisers, in May 1913 (paragraph 24, Third Report, page 26).

(2) Revised Regulations to govern the examinations for the rank of lieutenant, revised syllabuses and revised certificates all so framed as to ensure that officers shall have a reasonable knowledge of their duties before being advanced. That all these examinations shall be held at sea (page 145).

(a) That voluntary subjects shall no longer be included in these examinations. This was submitted in the First Report and has been already approved and acted on (page 155).

(b) That the awards of time giving accelerated promotion shall be reduced, by the abolition of voluntary subjects, from a maximum of 15 to 11 months (First Report, page 1, already approved).

(3) Revised Regulations to govern subsequent training and specialisation (page 164):—

That before promotion to the rank of lieutenant all sublieutenants shall serve 12 months at sea in that rank, including six consecutive months in the engine-room department, and obtain an engine-room watch-keeping certificate (paragraph 33, Third Report, page 29).

That additional facilities shall be given for the study of the military side of the naval profession by enlarging the scope of, and the numbers attending, the war course referred to in circular letter No. 10 of 1912, and transferring the War College to Greenwich (paragraph 48, Third Report, page 33).

B.

Revised Regulations for the entry of Naval Cadets and for their training at the Colleges (page 46):—

That the education, including the courses of instruction and system of examination, at present given at the Osborne and Dartmouth Colleges is satisfactory, but that more time and attention shall be given to navigation and pilotage, in order to provide for the reduction of time in the training cruiser (paragraphs 14 and 15, Third Report, pages 23 and 24).

That to increase the number of Candidates a system of *Bursaries* or reduced fees shall be established (paragraph 10*d*, Third Report, page 22).

- (a) that the age of entry at Osborne College shall remain unaltered, viz. between 12 $\frac{1}{2}$ and 13 years (paragraph 10*e*, Third Report, page 22).
- (b) that length of time spent at Osborne and Dartmouth shall remain unaltered, viz., four years in all (paragraph 14, Third Report, page 23).

NOTE.—The question of rebuilding Osborne College will be dealt with in the Committee's Fourth Report.

C.

That the officers for the engineering staff for special employment, *e.g.*, at the Admiralty, in H.M. Dockyards, &c., shall be selected from volunteers among those who qualify as lieutenants (E.), shall go through a special advanced course lasting two years at Greenwich College, shall devote their whole career to engineering, shall be placed on a separate list and shall not be eligible for military command (paragraph 16, Third Report, page 32).

That special arrangements shall be made for their promotion (paragraph 46, Third Report, page 33).

Summary of further Minor Recommendations.

The recommendations of the Committee also provide :—

- (1) That a Medical Board of Appeal shall be instituted to meet cases in which a parent or guardian of a candidate for a cadetship is not satisfied with the result of the official medical examination, (page 46, paragraph 5).
- (2) A revised Form E. 190, (page 120).
- (3) That the annual examination of midshipmen shall be abolished, (paragraph 23 of Third Report, page 26).
- (4) That the examinations in gunnery, torpedo and engineering for the rank of lieutenant shall be held six months after those in seamanship and navigation, instead of eight months after, as at present, and thus the time of promotion to lieutenant will be accelerated by two months, (paragraph 32, Third Report, page 29).
- (5) That a sublieutenant, after he has obtained an engine-room watchkeeping certificate, shall receive additional pay at the rate of 2*s.* 6*d.* a day if called upon to do duty in the engine-room department, (paragraph 34, Third Report, page 29).
- (6) That all officers qualifying as lieutenants (G.) or (T.) shall undergo a six months' course at the Royal Naval College, Greenwich, followed by an eight months' course in the "Excellent" or "Vernon" (paragraph 11, Third Report, page 31).
- (7) That an additional higher course of training of six months' duration shall be instituted at the Royal Naval College, Greenwich, for a limited number of lieutenants (G.) and (T.), (paragraph 42, Third Report, page 32).
- (8) That the additional pay of a lieutenant (G.) or (T.) shall be as follows :—
for those who obtain a first class certificate at the end of the courses,
4*s.* a day;
for those who obtain a second class certificate at the end of the courses,
3*s.* a day, (page 167).
- (9) That all officers qualifying as lieutenants (E.) shall undergo a six months' course at the Royal Naval College, Greenwich, followed by a practical course of approximately 1 year's duration at Keyham College, (paragraph 44, Third Report, page 32).
- (10) That the additional pay of a lieutenant (E.) shall be as follows :—
for those who obtain a first class certificate at the end of the courses,
5*s.* a day;
for those who obtain a second class certificate at the end of the courses,
4*s.* a day, (page 167).

Dates for Proposals to take effect.

The Committee propose that:-

1. The Regulations for entry and training (enclosure 4, Third Report, page 16) shall come into force after the first entry of cadets in the year 1913, *i.e.*, after 15th January 1913.
2. The Regulations for the training of junior officers (enclosure 18, Third Report, page 126) shall come into force after 15th January 1913.
3. The Regulations to govern the examinations for the rank of lieutenant (enclosure 25, Third Report, page 115) shall come into force for those officers who present themselves for examination in seamanship after January 1913.
4. The revised Form E. 190 (enclosure 17, Third Report, page 120) shall be issued forthwith for use in respect to all officers who entered the navy after January 1906.
5. The first officers from whom the engine-room watchkeeping certificate (enclosure 30, Third Report, page 156) will be required shall be those whose seniority as sublieutenant is dated after 31st March 1914.
6. The reduction in the cruiser time shall commence in May 1915 (para. 16, Third Report, page 24).
7. Naval instructors shall be removed from all sea-going ships, except the training cruisers, in May 1913 (para. 24, Third Report, page 26).

Programme of Changes proposed.

					Examination.
	Entry.	Join Cruiser.	Join Fleet.	Seamanship and Navigation.	Gunnery, Torpedo and Engineering.
Seamanship and navigation / advanced four months and held at sea.	Jan. 1905 May 1905	Jan. 1909 May 1909	Sept. 1909 Jan. 1910	Sept. 1912	September 1912 Jan. 1913
Seamanship and navigation / advanced eight months.	Sept. 1905	Sept. 1909	May 1910	Sept. 1912	May 1913
First examinations at sea under the proposals of the Committee.	Jan. 1906	Jan. 1910	Sept. 1910	Jan. 1913	Sept. 1913
Intervals between the two examinations reduced to six months.	May 1906	May 1910	Jan. 1911	May 1913	Nov. 1913
First officers from whom engine-room watchkeeping certificates will be required.	Sept. 1906	Sept. 1910	May 1911	Sept. 1913	March 1914
First entry for whom the Cruiser Course will be shortened to four months.	Jan. 1911	Jan. 1915	May 1915	Sept. 1917	March 1918

COMMITTEE ON EDUCATION.

ADMIRALTY, S.W.,

SIR,

18th May 1912.

Be pleased to inform the Lords Commissioners of the Admiralty that, in conformity with the terms of reference contained in Admiralty Letter C.W. 11589, dated 26th March 1912, considerable progress has been made in the inquiry into the training and education of Naval Officers of the Military Branch. The Committee have examined 36 officers selected both from those who have served, or are serving, in the fleet or training cruisers with midshipmen of the new scheme, and from those who have taken part in examining them for the rank of lieutenant. Three sub-lieutenants and one midshipman of the new scheme have also been examined. The officers who have given evidence have been of different ranks, and have been drawn from the Military Branch, the Engineer Branch, and the Naval Instructors. The Director of Naval Education has also been examined on the questions dealt with in this report.

2. The evidence given has shown that certain points referred to the Committee are pressing, require immediate attention, and can be settled provisionally without prejudice to the final recommendations. The Committee propose to deal with these points in successive preliminary reports.

3. The most urgent need is to relieve the pressure of the existing examination for the rank of lieutenant. Its tendency heretofore has been to place practical training and professional knowledge in the background, while the accumulation of marks in the examinations has found a front place. Witness after witness has declared that the examinations are governing and impairing the professional training at sea.

The pressure exerted is largely due to the greatly accelerated promotion--15 months and under—offered to those who are successful. The direction in which the pressure acts is governed by the nature of the examinations, which consist largely in giving written answers to questions on paper.

4. The evidence has shown that the practical professional knowledge of a large proportion of midshipmen, on passing for the rank of lieutenant, leaves much to be desired.

5. The accumulation of marks must necessarily be the dominating idea in the minds of all the midshipmen, whether clever or backward. The clever ones are influenced by the very large professional advancement offered as the reward of success. Of the third entry under the new scheme, the first one will pass over the heads of all the first entry except eight, and of all the second entry except three, while the fifteenth will pass over four of the first entry, and twenty-nine of the second. The first one of the fifth entry will probably pass over the heads of about 170. The backward ones, realising that the examination is based largely upon what may be described as "book knowledge," work this up in an endeavour to obtain enough marks to escape failure, and are consequently diverted from learning their work as officers.

6. The examinations held in May 1911 were based on the syllabuses laid down in Admiralty Circular Letter No. 51, dated 1st May 1908. Later ones have been governed by revised and reduced syllabuses issued in August and September 1911. If the midshipmen are to acquire a practical knowledge of their profession it is evident that further changes are required.

7. Among the causes which have tended to produce the existing state of things are the so-called "Voluntary Subjects," which include the science group—Mathematics, Mechanics and Heat, Electricity - besides Languages and Naval History. With regard to these it is to be observed that the main purpose of the examination is undoubtedly to determine the fitness of the candidates for performing their duties as lieutenants. It will be admitted that if necessary all other considerations must give way to this, the supreme one. The examination, however, as now conducted, aims at two other ends :—

- (i) Placing the candidates to some extent in order of merit ; and
- (ii) Encouraging the habit of studying subjects lying outside the absolutely necessary professional routine.

8. In so far as the latter was the purpose of the inclusion of the voluntary subjects in the examination, the evidence shows that the purpose has failed. Few, if any, of the midshipmen seem to devote any serious study to these subjects, unless it be during the few weeks immediately preceding the examination. Frequently they take the examination on the chance that their previous education will enable them to make some marks out of it. In so far as this is the case, the "time" awarded on the voluntary subjects is given for a supposed habit of study which has not existed, and in reality for an ability and knowledge which have already been rewarded by "time" on passing out of the colleges and the cruisers.

9. On the other hand it appears that the very existence of voluntary subjects has tended to increase the pressure towards school work and to this extent has been positively injurious.

10. Further, there can be no doubt that the requirements of the examination, apart from the voluntary subjects, are very heavy, and that even for the ablest midshipmen there is ample scope for study—for reading and thought as well as for practical work—in connection with the obligatory subjects. Such knowledge of the science group as is absolutely necessary for all officers will, in the ordinary course, be included in their professional examination for the rank of lieutenant. Any further knowledge of that nature required by individuals or specialists can be acquired by them independently and during their specialist courses.

11. Again, neither foreign languages nor naval history come strictly within the knowledge required to perform the duties of a lieutenant. It is acknowledged that both are important, but provision to encourage the acquisition of a knowledge of languages and the study of naval history can be made in other directions.

12. Finally, it is urged that a professional examination which must be taken by all should be kept as directly to its main end as possible, and should not be used as an indirect means for cultivating other qualities which, however valuable in themselves, are not essential for the main purpose, nor for all candidates, and which, indeed, as in the present case, are really valuable only when they are spontaneous.

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15. The Committee propose :—

- (i) That after the examination to be held in September 1912 all voluntary subjects shall cease to form part of the examination for the rank of lieutenant, and that the maximum number of marks in the scale laid down in Article **309A** of the King's Regulations shall be reduced from 12 to 10 ;
- (ii) That as provisional measures, until the Committee can inquire into the whole question :—
 - (a) Examinations in foreign languages shall continue to be held, but only for the money prizes awarded under Article **352A** of the King's Regulations and for the Ryder prize ;
 - (b) The essay on naval history shall be temporarily discontinued.

16. If the orders are issued at once, the officers who are to pass in January 1913 will have eight months' notice. In the opinion of the Committee this will be sufficient warning, in view of the pressing necessity for the change.

17. The effect of these proposals will be as follows : -

- (i) The tendency to divert midshipmen from their practical work to the school room will be reduced ;
- (ii) The maximum accelerated promotion will be reduced from 15 months to 11 ;
- (iii) Sub-lieutenants will have to serve at least 13 months in that rank, instead of only 9 ;
- (iv) The pressure to provide instruction, however imperfect, in the voluntary science subjects at sea, will be removed.

We have the honour to be,

Sir,

Your obedient Servants,

REGINALD CUSTANCE,

Admiral (Chairman) ;

R. E. WEMYSS ;

Rear-Admiral ;

VICTOR A. STANLEY,

Captain ;

R. B. DIXON,

Engineer Commander ;

W. C. FLETCHER,

Chief Inspector of
Secondary Schools,

VICTOR H. T. WEEKES,

Secretary.

} Members.

The Secretary of the Admiralty.

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Second Report ad interim.

COMMITTEE ON EDUCATION.

ADMIRALTY, S.W.,

SIR,

14th June 1912.

With reference to Admiralty Letter C.W. 11,589, dated 26th March 1912, which ordered an inquiry into the training and education of Naval Officers of the Military Branch, be pleased to lay before the Lords Commissioners of the Admiralty this report on the question embodied in I. (a.) of the terms of reference, viz., whether cadets should go to a training cruiser before joining the fleet.

2. Naval cadets are kept at schools on shore until an average age of $16\frac{1}{2}$ years in order to complete their general education before going to sea. Without prejudging the education given at the colleges, which has not yet been examined, the results on the professional side can be stated.

3. The Committee find, as was to be expected, that the cadets on joining the training cruisers from Dartmouth College are ignorant of ship life, have no knowledge of their duties on deck, in boats or in the engine-room, and have had no opportunity to command men. The average cadet's knowledge of navigation is limited. He has a fair theoretical knowledge of machinery and understands the use of engines, the run of pipes, and in general the things to look for in an engine-room, but he has little or no practical knowledge of the machinery itself or of refitting it, or of the internal fittings of a ship. He has not sufficient experience to be able to raise steam and run the engines of a small boat without supervision. He has a fair theoretical knowledge of magnetism, dynamos, motors and searchlights, but his practical knowledge of these is very slight indeed. None of the cadets have any knowledge either of torpedoes or of gunnery.

4. It is recognised that young men nearly 17 years of age should not be sent to the seagoing fleet as officers with so little professional knowledge as this, since they would not be able to take part in the work of their ships. To this great importance is attached, because the training of midshipmen at sea always has largely depended, and still depends, on themselves, *i.e.* on their doing this work, which they will not be in a position to undertake until some elementary practical knowledge of it has been acquired.

5. The average midshipman will acquire this necessary knowledge more quickly on board a training cruiser, where the instruction is systematic, than he will on board the average seagoing ship, where the officers may have neither the time nor the inclination to teach the rudiments, and where the training only becomes effective when the average midshipman has been sufficiently grounded to be able to take advantage of it.

6. For these reasons, and seeing that any changes which may be found possible in the colleges cannot take effect for some time, the Committee recommend that the two training cruisers of the "Cornwall" class should be retained for the present. The instruction given on board them, however, should aim more than is now the case at fitting the cadets to take part in the work of a seagoing ship on deck and in the engine-room and to be of some assistance to the gunnery, torpedo and navigating officers.

7. The training on board these cruisers is at present governed by the memorandum issued with Admiralty Letter N. 11,534, dated 5th December 1906, addressed to the Commander-in-Chief, Portsmouth. The arrangements provide for a weekly cycle, that is to say, the cadets are divided into three sections and the subjects into three groups—in the words of the memorandum—*School, Engineering, Seaman*ship. Each section of cadets takes a group of subjects for two days, and then changes rounds, so that the cycle is completed in six working days, *i.e.*, in one week.

8. The resulting division of time, as reported by the "Cumberland," is as follows (the cruise being taken as admitting of twenty-four working weeks):—

	<i>School Group.</i>						Hours.
Mathematics and Navigation	-	-	-	-	-	-	147
Applied Electricity	-	-	-	-	-	-	28
Applied Mechanics	-	-	-	-	-	-	32
Drill, &c.	-	-	-	-	-	-	40
							—
							247
							—
	<i>Engineering Group.</i>						
Engineering, including Heat and Steam	-	-	-	-	-	-	206
Applied Mechanics	-	-	-	-	-	-	41
							—
							247
							—
	<i>Seamanship Group.</i>						
Seamanship	-	-	-	-	-	-	136
Torpedo	-	-	-	-	-	-	13
Gunnery	-	-	-	-	-	-	28
Pilotage	-	-	-	-	-	-	28
Drill, &c.	-	-	-	-	-	-	40
							—
							245
							—

Or arranged by subjects and irrespective of groups:—

		Hours.	Total Hours.
Navigation and Mathematics	Two days a week	147	175
Pilotage	Once a week	28	
Engineering, including Heat and Steam	Two days a week	206	247
Applied Mechanics	-	41	
Seamanship	Two days a week	136	
Torpedo	Once a week for two weeks out of three	13	41
Applied Electricity	Twice every third week	28	
Gunnery	Once a week	28	
Applied Mechanics	In school group	32	
Drill, &c.	Four days a week	80	
		739	

The times in the "Cornwall" appear to differ to some extent from those in the "Cumberland."

9. The subjects of study in the cruiser were originally set forth in syllabuses, which formed an Appendix to the Report of the Director of Naval Education for the year 1908. Amended ones were introduced in March 1912,* the principal changes being:—

A reduction in Optional Mathematics:

Large reductions in Applied Mechanics and in Heat and Steam, certain parts of each of these being reserved for advanced cadets:

A small reduction in Navigation and Nautical Astronomy:

An entirely new syllabus for Applied Electricity.

The remaining subjects remained practically unaltered.

10. The division of time, the syllabuses, and the system of instruction,—which last has been largely based on a system of lectures and much influenced by the final examinations,—all show that the tendency has been to use the cruisers in some degree

* Enclosure No. 3 (page 10).

too much as floating schools to continue the work of the colleges, and too little as training ships to teach the work to be done in seagoing ships.

11. The weekly cycle may lend itself to meet the requirements of the final examination as hitherto carried out, but does not seem to be suited for teaching practical work. For example, it is considered that no real practical knowledge of the Whitehead Torpedo can be acquired in an hour-and-a-half once a week spread over twenty-four weeks, whereas the same instruction given in eight weeks would give a useful insight.

12. The time given (para. 8) to the military subjects Gunnery and Torpedo, as well as to the important subject Electrical Work, place the three in a secondary position. Only 69 hours are given to them, whereas 73 hours are devoted to Applied Mechanics, and much longer times are given to Navigation and Pilotage, to Engineering and to Seamanship respectively. Now, Gunnery, Torpedo, and Electrical Work include a considerable part of the work on board a ship-of-war, to participate in which the cadets should be prepared in the cruiser. It would seem that they are given insufficient opportunity to acquire the knowledge of these subjects, and that they join the fleet less well grounded in them than they should be.

13. The Committee recommend that a twelve-weekly cycle of instruction shall be adopted, and that the subjects be grouped thus:—

A. Group	-	-	-	-	-	{ Seamanship ; Torpedo and Electrical Work :
B. Group	-	-	-	-	-	Engineering :
C. Group	-	-	-	-	-	{ Navigation ; Pilotage ; Gunnery.

Each section of cadets will take each group of subjects for four weeks and then change rounds, so that the cycle will be completed in twelve weeks. In the A. group three-sixths of the time will be given to Seamanship, two-sixths to Torpedo and Electrical Work, and one-sixth to Physical Drill, &c. In the C. group six-twelfths will be given to Navigation, two-twelfths to Pilotage, three-twelfths to Gunnery, and one-twelfth to Physical Drill, &c. The routine of instruction is set forth in detail in Enclosure 4.*

14. The resulting division of time will be:—

									Hours.
Seamanship	-	-	-	-	-	-	-	-	121
Torpedo and Electrical Work	-	-	-	-	-	-	-	-	81
Engineering	-	-	-	-	-	-	-	-	242
Navigation	-	121	{	-	-	-	-	-	161
Pilotage	-	40	}	-	-	-	-	-	
Gunnery	-	-	-	-	-	-	-	-	60
Physical Drill, &c.	-	-	-	-	-	-	-	-	60
									725

The times allotted to Torpedo and Electrical Work, to Gunnery, and to Pilotage, have been increased, while those given to Seamanship, to Applied Mechanics, to Optional Mathematics (included under Navigation) and to Physical Drill have been decreased.

15. The syllabuses as amended in March 1912 still cover more ground than can be thoroughly covered in six months and do not concentrate enough attention on the knowledge essential to midshipmen on joining a seagoing ship. Take for example Optional Mathematics, which is taught in the hours allotted to Navigation. It is considered better to concentrate the whole attention on the latter and to abolish the former. Again, in Torpedo and Applied Electricity the syllabus has been so interpreted that the instruction has taken the form of lectures rather than of handling the Whitehead Torpedoes and electrical gear actually to be found on board a ship. It is the same in Gunnery. When a cadet joins a seagoing ship it is the use of the gun and the management of its crew that are of importance to him. Its construction,

the properties of cordite, &c., are matters for a later stage in his career. Similarly with Engineering, his main object should be to get into practical touch with the machinery, and with the work of the engineering department.

16. The course of instruction and the syllabuses which the Committee recommend for adoption are to be found in Enclosure No. 4.* Both have been drawn up with a view to preparing the cadets to perform some of their duties as officers on joining a seagoing ship. Only the most essential things have been retained, but these include such a wide range of subjects new to the cadets that in the opinion of the Committee no more can be properly absorbed and digested in such a limited time.

17. The examination on leaving the cruiser has hitherto included the following papers set by outside examiners under the direction of the Director of Naval Education :—

No. of Papers.	Subject.
2	Navigation,
2	Seamanship,
1	Applied Electricity,
2	Engineering,
1	Applied Mechanics,
1	Mathematics (Optional) :
<hr/> 9	

and the following papers set by Ship's Officers :—

No. of Papers.	Subject.
1	Pilotage,
1	Seamanship,
1	Gunnery,
1	Torpedo,
1	Shipbuilding (in "Cumberland" only).
<hr/> 5	

About one-half of that in Seamanship and a small portion of that in Engineering have been conducted orally, but as a whole the examination may be said to have consisted in giving written answers to printed questions. It is to be noted that papers were set in Pilotage, Seamanship, Gunnery, Torpedo and Shipbuilding even when conducted by the ship's officers, and even although a *vis à vis* examination in such subjects is admitted to be more searching and effective. An explanation is to be found in the fact that it is practically impossible for the ship's officers to examine 60 cadets orally in the time at their disposal. Changes were introduced in March 1912, but substantially the system remains unaltered.

18. The allotment of marks in the examination was amended in March 1912. The original and amended figures are as follows :—

	Original.	Amended.	Difference.
Navigation and Pilotage	850	850	—
Engineering including Heat and Steam	600	850	+ 250
Seamanship	850	800	- 50
Torpedo and Applied Electricity	250	300	+ 50
Gunnery	200	200	—
Optional Mathematics and Applied Mechanics	600	350	- 250
Term work in Navigation and Science group	150	150	—
	3,500	3,500	

It will be seen that 250 marks were transferred from Optional Mathematics and Applied Mechanics to Engineering, and 50 marks from Seamanship to Torpedo and Applied Electricity.

19. On the result of the examination time is now awarded which accelerates promotion. Those cadets who are awarded First Class Certificates gain two months, and those who receive Second Class one month.

20. As at present arranged, the outside examiners act as a check on the instructing staff, but to employ them necessitates an examination at the end of the cruise, which must be conducted mainly on paper, and not *rivâ voce*, owing to exigencies of time. The paper examination tends to make the cadets more concerned to learn how to give written replies to questions than to master the actual work, which should be the main purpose for which they go to the cruiser. Again, a paper examination can never enable an outsider to appreciate the knowledge and ability of a cadet as well as can the officers of the ship after six months' contact and aided by test examinations.

21. The Committee are of opinion that the examination should rest with the ship's officers, and that to supply the necessary check on them a full report (see Enclosure 4),* should be forwarded from the ship at the end of each cruise, and a biennial inspection of the training and instruction should be held by a specially selected flag officer, who should be furnished with copies of the reports sent in since the previous inspection, and who should be accompanied by competent assistants. They further recommend, in lieu of the final examination as at present carried out :—

- (a) That a test examination shall be held on completing each period of instruction in each subject :
- (b) That at the end of the cruise the captain and officers of the ship shall assess the knowledge and ability of each cadet in each subject, basing their awards on their personal knowledge of him and on the results of the test examinations.†

22. The abolition of the external examination raises the question of the award of time giving accelerated promotion. In the view of the Committee the career of a naval cadet and midshipman is divided into two main parts: (1) the school course at the colleges, (2) the training at sea, of which latter the training in the cruiser distinctly forms an important part. Any rewards offered in the shape of "time" should be given at the end of one or both of these periods and not in the middle of either, that is to say, on leaving Dartmouth or on passing for the rank of lieutenant. This principle has been recognised in the school course, since the Osborne results are not carried forward, and in the opinion of the Committee it is equally applicable to the cruiser-training. The reason usually given for awarding time to accelerate promotion is that it acts as an incentive to work. That reason seems to be based on a misapprehension. The force which is believed to act most strongly on a boy or young man is the desire either to excel or at least not to be thought inferior to his fellows. It is that which urges him to get into a higher form at school, into the cricket eleven and into the football team. But he requires some public recognition that he does excel. That recognition the cadet has had hitherto in the class of certificate awarded. The time now given to those who take first or second class certificates is believed to be altogether secondary in its effect, more especially as it only comes into operation some years later. Properly conducted, monthly test examinations will, it is believed, act as more powerful incentives to work than does the award of time, provided the results of each examination are at once made known and show the cadets of each section in order of merit. The Committee recommend that on leaving the training cruiser the award of time to accelerate promotion shall be abolished.

23. On leaving Dartmouth the certificate on page 3 of Form E. 190, with the alterations shown in Enclosure 6,‡ will be filled up by the captain of Dartmouth College. On completing service in the cruiser a second certificate, in the form shown in Enclosure 5 will be filled up by the captain of the ship.

24. Hitherto the "Cumberland" has returned home in the middle of the cruise to give leave, while the "Cornwall" has not done so. The Committee are of opinion that the former practice is open to objection, and have therefore provided in the proposed regulations for an unbroken cruise of twenty-seven weeks, which will give a margin of three weeks, as the course will last only twenty-four working weeks. The interval between the departure of one batch of cadets and the arrival of the next will be about seven weeks.

25. The Committee propose :—

- (a) That the regulations for the training cruisers embodied in Enclosure No. 4 shall come into force when the next batch of cadets join the "Cornwall" in September 1912 ;
- (b) That after the cadets now on board the "Cumberland" have completed their course, that is after December 1912, the award of time on leaving the training cruiser shall cease ;
- (c) That a biennial inspection of the training and instruction carried out on board each ship shall be held by a specially selected flag officer, the first one being held not less than eighteen months after these proposed regulations have been put into force.

26. The Committee submit that the alterations which will be required in Articles 270 and 308 of the King's Regulations in consequence of the abolition of the award of time on leaving the cruiser, shall be deferred until they can make a submission dealing with the whole question of the college courses and sea training.

27. If these proposals are approved—

- (a) The "Cumberland" will require an assistant navigator as well as the "Cornwall" ;
- (b) Both ships will require a warrant officer to assist the lieutenant (T.) in the instruction ;
- (c) The following additional gear will be required by each ship for instructional purposes :—
 - 1 torpedo director,
 - 1 old whitehead torpedo,
 - 2 old motors,
 - 1 starter,
 - 1 controller,
 - 1 old automatic searchlight lamp.

28. The effect of these proposals will be—

- (a) The six months in the cruiser will become part of the sea training instead of forming part of the college school course ;
- (b) The training in the cruiser will become more practical and will be a better preparation for the seagoing fleet ;
- (c) The majority of officers will reach the rank of lieutenant from two months to a fortnight earlier than they would under the present regulations, since no officer's advancement will be delayed by failing to take a first or second class certificate on leaving the cruiser, as is the case at present.

We have the honour to be,

Sir,

Your obedient Servants,

REGINALD CUSTANCE,

Admiral (Chairman);

R. E. WEMYSS,

Rear-Admiral ;

VICTOR A. STANLEY,

Captain, R.N. ;

R. B. DIXON,

Engineer Commander ;

W. C. FLETCHER,

Chief Inspector of

Secondary Schools ;

Members.

VICTOR H. T. WEEKES,
Secretary.

The Secretary of the Admiralty.

* * * * *

Enclosure No. 3 in Second Report of Education Committee, dated 14th June 1912.

(EXTRACT FROM 1912 SYLLABUS.)

TRAINING OF NAVAL CADETS.

The following Syllabuses show the subjects of instruction of Naval Cadets under the New Scheme of Training from entry until they pass out of the Training Cruisers as Midshipmen. They include

- I. Subjects of Study at the Royal Naval College, Osborne.
- II. Subjects of Study at the Royal Naval College, Dartmouth.
- III. Subjects of Study in the Training Cruisers.

The training of Naval Cadets begins at Osborne, where they spend two years each comprising three terms. They next proceed to Dartmouth for two years, and thence to a Training Cruiser for two terms. Then they go to sea as Midshipmen, and after three years' service in that rank they are examined for the Rank of Lieutenant. The limits of age at entry are 12 $\frac{2}{3}$ and 13. Cadets therefore become Midshipmen normally at age 17 $\frac{1}{3}$ –17 $\frac{2}{3}$.

* * * * *

III. -THE TRAINING CRUISERS.

MATHEMATICS. - (Optional.)

Trigonometry. The addition formulæ. Value of $\sin 2A$, $\cos 2A$, $\tan 2A$, $\sin 3A$, $\cos 3A$. The product formulæ. Plotting of functions: graphical solutions of equations. Inverse trigonometrical functions. Proof of the fundamental formula of Spherical Trigonometry and its derivatives. Three planes meeting at a point; relations between angles between the three planes, and their lines of intersection. Napier's rules of circular parts.

Calculus. Differentiation of x^n , $\sin nx$, $\cos nx$, $\tan nx$, e^{ax} , $\log x$. Differentiation of a sum, a product, a quotient, a function of a function. Successive differentiation. Calculation of small corrections. Especially (in Navigation) error in calc. zenith distance due to small error in hour angle or declination, and error in hour angle due to small error in declination. Maxima and minima. Integration of x^n , $\sin nx$, $\cos nx$, $\sec^2 nx$, $\frac{1}{x^a}$, $\sin^2 x$, $\cos^2 x$, $\frac{1}{x^2 + a^2}$, $\frac{1}{\sqrt{a^2 + x^2}}$.

$\frac{ax + b}{cx + d}$ Definite integrals. Areas of curves, and volumes of solids of revolution.

Guldinus' Theorem. Centre of gravity, moment of inertia, centre of pressure by integration, in simple cases. Proof of Simpson's rule. Integral giving mer. parts for given latitude.

NAVIGATION AND NAUTICAL ASTRONOMY.

Position line of latitude by meridian altitude of sun, star, or planet. Latitude by Polestar.

Meaning of position line generally. Position line by altitude of sun, star, moon, or planet.

Use of a single position line in conjunction with dead-reckoning.

Fix by one position line and bearing of distant object. Fix by two position lines taking account of distance run between the sights. (Cadets to make their own plotting chart.)

Deviation by alt.-azimuth (sun or star).

Deviation by time-azimuth (sun or star).

Use of azimuth tables.

Error and rate of chronometer (by sun or star).

Easy time problems. Proofs of (i) S. Sid. Time = S.M.T. + R.A.M.S. (ii) Star's H.A. = S.M.T. + R.A.M.S. – R.A. Star. Time of meridian passage of stars.

Easy scouting problems.

Easy problems on sunrise, sunset and twilight.

Easy current sailing. Great circle and composite sailing.

Moon sights (but not proofs of Moon corrections).

Compass deviation: its component parts: their causes and correction.

PRACTICAL NAVIGATION.

Correction of courses and bearings. Laying these off on chart. Fixing ship's position by cross bearings; by two bearings of a shore object and the run in the interval; four point bearings. Fix by bearing of an object and vertical angle. Sun, star, planet, and moon sights worked by the "New Navigation" method. Latitude by sun or star meridian altitude. Latitude by Pole-star. Fix by two observations of heavenly bodies, allowing for run; by one observation of a heavenly body and the bearing of a shore object. True bearing and distance of a place by Mercator's Sailing.

(The above to be done on a chart, and all positions to be obtained by plotting on the chart.)

APPLIED MECHANICS

(The items in square brackets are for the more able Cadets only.)

Revision of elementary ideas, especially in statics. Resolution of forces. Moments. Conditions of equilibrium.

Friction between solid bodies. (Friction of a rope on bollard or belt on pulley.) Use of a rope brake or other absorption dynamometer in measuring power.

Idea of mechanical advantage in a machine. Velocity ratio. Mechanical efficiency. Apply the principle of work to such examples as a lever, pulleys, Weston's purchase, screw, worm and tangent wheel.

[Use of instantaneous axis in finding velocity ratio. Crank-effort for a given piston pressure. Crank-effort diagram on a straight line base (omitting effects of inertia). Combination of cranks to give a more uniform effort.]

Elementary strength of materials. How to find graphically the pull and thrust in members of a loaded frame. Simple examples of reciprocal figures for roofs and cranes. (Omit use of fumicular polygon.)

Effects of tension or simple compression. Elastic and non-elastic strain. Elastic limit. Hooke's Law. Young's Modulus of Elasticity E . Ultimate strength and extension in a tensile test.

Relation of safe stress allowed in practice to ultimate strength. Safe stress in iron and steel. Effect of repeated loads.

Stress in boiler shell due to internal pressure. Circumferential and longitudinal tension.

Meaning of shearing stress. Compare strength of rivets to resist shear with tensile strength of plate in a riveted joint.]

[Nature of strain due to shearing stress. Example in the torsion of a shaft.] Angle of elastic twist in a given length of a shaft proportional to twisting moment. Application in torsion dynamometers to measure power transmitted by a shaft. Practical forms of torsion dynamometer used in the Service.

Bending of a beam. Meaning of bending moment and shearing force at any section. Nature of the stresses due to bending moment. Forms of section giving strength to resist bending. Diagrams of bending moment in simple cases of a loaded beam or bracket. Stress due to load in a hook and in a davit.]

APPLIED ELECTRICITY.

Cells and batteries in use in the Service. Simple testing of circuits and batteries.

DYNAMOS. - Voltages in use in the Service- advantage of using higher voltage. Series, shunt, and compound dynamos. Necessity for and advantages of parallel running. Compound dynamos in parallel. Use of equaliser, shunt regulator, and shunt protector. Safety arrangements required in a parallel switchboard.

Internal Lighting and Power Circuits. - "Tree" and "Ring" systems. Sketch of typical lighting circuit. Methods of locating earths. Ring main system - general principle and advantages - brief description with sketch. Fittings used in lighting circuits. Use of Police light. Locating an earth on lighting circuit.

Motors. - General explanation of torque, back E.M.F., &c., and relations between them. Series and shunt motors- their behaviour under varying loads; starting torque; methods of regulating speed, and Service use of both types. Motor starters and controllers. Magnetic brakes. Electrical and over-all efficiency, Ward-Leonard system of control.

Arc Lights. The electric arc. Use of artificial resistance. Principle of automatic work (e.g. Sketch of searchlight, automatic lamp, and Crompton coaling arc lamp. Use of arc deflector and method of adjusting voltage of feeding. Practical instruction in burning searchlight and coaling arc lamp. Projectors and mirrors. Searchlight circuits; advantages of 60-volt arc and of decreasing the focal length of mirrors. Working searchlights at night.

20-Volt Switchboard. Sketch and Description of. - Gun circuits (not turrets) and night sight circuits. Tests for gun circuits.

Fire Control. General description of system, grouping of guns, &c. Description of instruments. Instruments required for each group in control position and at guns. Method of putting instruments in step. Description of change-over switches. Description and sketch of fire-control circuits from one group of 6-inch guns. Use of mast junction boxes.

Telephones. Explanation of instruments. Direct and induced working. Navyphones for ship's use and fire-control purposes. Method of joining up. Light Q.F. and searchlight control. Method of working telephones off motor-generator (brief description only).

HEAT AND STEAM.

(*The items in square brackets are for the more able Cadets only.*)

Fahrenheit and Centigrade scales of temperature. Absolute scale of temperature and reason for its use. First law of Thermodynamics. Joule's equivalent. Unit of heat. Specific heat of solids and liquids. Conduction, Convection, and Radiation with examples of each. Transference of heat in a boiler. Heat insulation.

Latent and total heat of formation of steam. Dryness fraction and specific volume. Formation of steam at constant pressure. External work. [Distinction between specific heats of gases at constant pressure and at constant volume.]

Forms of expansion curve. Adiabatic expansion of steam. [Calculation of dryness fraction at the end of adiabatic expansion.] Mean pressure during hyperbolic expansion.

Requirements of a good indicator and rig. Defects that are in practice shown by the diagram. Practical work with the Indicator.

Principal differences between theoretical and actual diagrams. Reasons for the use of stage expansion. Total ratio of expansion. Effect of independent linking up.]

[Greater importance of low vacuum for a turbine than for reciprocating engine. Effect of presence of air in condenser. Uniflux condenser. Dual air pump.]

Thermal efficiency. Example of a particular engine worked out, and typical values for the efficiencies of boiler, steam, engine, propeller, &c., given. Calculation of necessary circulating water.

Impurities of boiler water. Reasons for avoiding sea water. Corrosion in boilers, active or inactive. Galvanic action. Zincs. Acidity. Tests of boiler and feed water. Hydrometers. Nitrate test with the distinction between precipitates of salt and lime by nitric acid.

Unresisted expansion. Heat transformed into kinetic energy. [Flow of steam through nozzles. Ratio of pressures for maximum flow. Calculation of velocity produced by a given drop in total heat.] Injectors and Ejectors, Diagram [and principle of action].

Distinction between Impulse and Reaction Turbine. [Velocity diagram of steam passing through a row of moving blades.] General description of points of difference in action of de Laval, Parsons, and Curtis turbines. Graphs showing variation of pressure and velocity along a turbine.

Leakage over blade tips of a reaction turbine. Low efficiency of high pressure Parsons turbine. Impulse blading to reduce leakage at high pressure end. Reason for combination of reciprocating engine and turbine. Gain in weight and economy by the use of high speed turbines and reduction gearing. Result of trials.

[Three types of resistance of ships and how each varies with the speed. Relative importance at high and low speeds. Relation between I.H.P., speed, and coal consumption. Economical speed.]

Propeller definitions. [Expression for thrust and kinetic energy in race. Effect of increasing slip. Cavitation. Indicated thrust.] Distinction between propellers for turbines and reciprocating engines. Augmentation of resistance.

PRACTICAL ENGINEERING.

Precautions to be observed and difficulties occurring when getting under way, shutting off and finished with engines. Drain and steam pipe systems, with rough sketches. Filters, feed and distilling arrangements, with rough sketches. Defects occurring when at sea, and found on opening out. Adjustments and workshop methods on board ship. Boiler practice at sea and in harbour, with rough sketches. Adjustments, general engine-room practice and care and maintenance of machinery.—Description and sketches of main engine details.

SHIP CONSTRUCTION.

Materials used in construction and where used. Tests of the materials. Outline section through an armoured cruiser. Comparison of a ship to a loaded beam. Inner and outer bottom plating, deck beams and connections, longitudinal and transverse frames. Armour, its position and attachment—protective decks. Engine bearers. Coalings fittings and arrangements. Coal bunkers. Where watertight bulkheads are fitted. W.T. doors—their construction, how and where worked. Ventilating arrangements. Pumping and flooding arrangements, including fire mains. Metacentric heights. Angles of heel due to altering weights. Stability. Tons per inch immersion.

SEAMANSHIP.

Rule of the Road.—Colours and description of lights carried by all vessels. Thorough knowledge of all Board of Trade regulations for avoiding collisions under steam or sail, by day or night or in fog.

Signals.—Signal Manual. Pages 1, 2, 3; 5-36; 38; 39-41; 61, Art. 21; 65, Arts. 1, 2, 3, 5, 6, 7. Fleet Signal Book, pages 204, 205.

Anchors, Part I. Names and uses of all gear in connection with anchor work in the Service. Terms and definitions used in anchor work. Weighing and letting go single anchor.

Anchors, Part II. Knowledge of mooring and unmooring. Laying out bower, stream, or kedge anchor.

Boats, Part II.—Management under all reasonable conditions. Terms used in reference to the management of ships and boats under sail. Hoisting and lowering sea boats. Securing boats for sea. Use of boat ropes and disengaging apparatus. Name and fittings of all gear used in pinnace, cutter, and gig, including structural fittings.

Tackles, Derricks, Riggings, &c.—Knowledge of tackles, blocks, hawsers. Rigging purchases and boats' falls at present generally in use in the Service. Terms generally used at sea (Chapter IX., Seamanship Manual). Rules for estimating strength of hemp and wire rope; also advantage gained by tackles ordinarily used in the Service. Fair knowledge of different rigs of sailing ships. Bends and hitches, as per Chapter IV., Seamanship Manual. To rig rough sheers on board a ship to lift a capstan, gun-shield, or dismount a small gun; also rig a derrick for coaling purposes, &c.

Management of Boats under Sail, Steam, and Oars.

Practical Signalling.—Flashing, Semaphore, Morse.

Observation and Organisation.

GUNNERY.

Construction of a Modern Gun, showing how strength is obtained.

The Properties of Cordite and composition of a B.L. and Q.F. charge.

Sighting. Short description of a modern sight and its requirements. Thorough explanation of practical rules for sight adjustment. Sight-setting. The use and care of telescopes and night appliances.

Fire Control. Arrangements for controlling fire in a modern ship. Description of methods and instruments used. Each Cadet to be able to use range-finder and rate of change instruments efficiently and work the fire control.

Shooting. Practical rules and their application. Instruction in aiming appliances. Includes firing with aiming rifle and 12-pr. or 3-pr. guns.

Gun Drill. To know the duties of any number at a 6-inch casemate or 12-pr. Q.F. gun, and to be able to take charge of and drill a gun's crew. Cadets to be placed in charge of gun's crews of seamen towards end of instruction.

Guns, Mountings.—To have a fair knowledge of breech mechanisms, firing and safety arrangements, mountings of guns in the training cruiser.

Ammunition.—To know the appearance of projectiles, cartridges, tubes, fuzes, &c., and their use, and to understand methods of supplying and storage in the cruiser.

Rifle and Pistol.—To be able to use safely, and understand the sights.

TORPEDO.

Lectures.—General History of the introduction and evolution of the torpedo. General description of a typical torpedo. Heads. Pistols. Pioneers. Air vessels. Balance chamber mechanism and connections to horizontal rudders (R.G.F.), Servomotor (R.G.F.), Controlling gear (R.G.F.), Engines (R.G.F.), Gyroscope. Speed and ranges of torpedoes for different types of ships. Methods of discharge. Details of submerged tube. Explosives. Director.

Practical. Adjustments. Drill at submerged tube, working bar, &c. Firing from dropping gear. Practice with director.

CHARTS AND INSTRUMENTS.

General construction of standard compass. Bearings by compass. Reading charts. Methods of fixing position by compass. Practical fixing. Writing up log. Instruments and sounding machines. Winding and comparing chronometers. Correcting charts. Lighting and buoyage. Tides and uses of tide tables. Winds and currents in the North Atlantic. Laws of storms and elementary weather forecasting.

IV. PASSING-OUT EXAMINATION OF NAVAL CADETS.

PART I.—TAKEN ON LEAVING THE ROYAL NAVAL COLLEGE, DARTMOUTH.

Subjects.	Marks.
Mathematics I.	- 300
Mathematics II.	- 250
Electricity	- 200
Chemistry and Optics	- 100
Mechanics	- 250
Navigation and Charts (including 50 marks for Oral)	- 300
French or German (including 150 marks for Oral)	- 450
English Composition	- 200
History	- 200
English Literature	- 100
Engineering I.	- 200
Engineering II.	- 200
Mechanical Drawing and Workshop	- 150
Seamanship	- 100
Term Marks	- 1,000
	<hr/>
	4,000

PART II.—TAKEN ON COMPLETING THE COURSE IN THE TRAINING CRUISERS.

Subjects. Marks.

(Group A.—Navigation and Science.)

Mathematics (Optional)	- 150
Navigation I.	- 300
Navigation II.	- 300
Charts, &c.	- 250
Applied Mechanics	- 200
Applied Electricity	- 200
Heat and Steam	- 200
Term Work	- 150
	<hr/>
	1,750

(Group B.—Seamanship and Engineering.)

Engineering	- 300
Engineering (Oral and Practical, including 100 marks for Term Work)	- 350
Gunnery	- 200
Torpedo	- 100
Seamanship	- 800
	<hr/>
	1,750

First, Second, and Third Classes are awarded in Part I. and in each group of Part II.

The Class obtained in passing out counts afterwards towards promotion to the rank of Sub-Lieutenant, promotion being accelerated according to the following scale:—

For a First Class in Part I. - - - - - 2 months.

For a Second Class in Part I. - - - - - 1 month.

For a First Class in either group of Part II. - - - - - 1 month.

For a Second Class in either group of Part II. - - - - - $\frac{1}{2}$ month.

The greatest amount of time that can be gained on passing out is accordingly four months. The order of merit on passing out is determined by the aggregate results of both parts.

Enclosure No. 4 to Second Report of Education Committee, dated 14th June 1912.

REGULATIONS FOR THE TRAINING CRUISERS.

GENERAL PROVISIONS.

Each cruise will last for an unbroken period of twenty-seven weeks, counting from the time the cadets join until they are discharged.

2. Each cruise will be arranged :
 - (a) To avoid hot weather;
 - (b) To suit the cycle of instruction;
 - (c) To provide that the ship shall be under way during about one-third of the working days;
 - (d) To ensure that sufficient opportunity shall be given in close harbours to disconnect the machinery as necessary for the instruction of the cadets;
 - (e) To give opportunities for coasting, for gunnery, and for torpedo exercises.
3. At the end of each cruise a report is to be forwarded stating :
 - (i) The dates when the cadets joined and when they were discharged;
 - (ii) Dates of arrival and departure from each port;
 - (iii) The number of days and parts of days under way;
 - (iv) The average number of hours devoted to each subject;
 - (v) The average number of hours watch on deck and in the engine-room department kept by each cadet;
 - (vi) The average number of hours spent by each cadet on refitting : (a) main machinery, (b) auxiliary machinery and boilers;
 - (vii) The average number of times each cadet was instructed : (a) in handling steamboats under way; (b) in the engine-rooms and stokeholds of steamboats;
 - (viii) The number of times torpedoes were run for the instruction of cadets: (a) from the ship, (b) from the steamboats;
 - (ix) The average number of rounds fired by each cadet : (a) from one of the ship's guns, (b) from a rifle;
 - (x) Any circumstances which materially interfered with the routine of instruction;
 - (xi) Any suggestions for improving the system of training in the cruisers;
 - (xii) The results of the examinations.

Copies of all examination papers set for the cadets should be forwarded with the report.

Sub-Enclosure No. 1 to Enclosure No. 4 in Second Report of Education Committee, dated 14th June 1912.

TRAINING AND EXAMINATIONS IN THE CRUISERS.

The training on board the cruiser will last 24 working weeks and is to be directed to fit cadets to take part in the work of a seagoing ship on deck and in the engine-room, and to be of some assistance to the Gunnery, Torpedo and Navigating Officers of those ships.

2. The accompanying routine of instruction and syllabuses* are framed accordingly and on the idea that in all subjects practical instruction should take the first place, and that lectures should be considered of secondary importance.
3. All instruction should be supplemented by practice as much as possible, and no opportunity should be missed in the ordinary routine of the ship to let the cadets perform officers' duties under supervision.
4. To encourage the cadets to acquire knowledge themselves, and to give them self-confidence, it is desirable that, if possible, each cadet, during the latter part of the cruise, should give a short lecture on any subject matter included in the cruiser training. The subject should be settled about the middle of the cruise, and should be preferably one in which the cadet will show to the best advantage.
5. The test examinations to be held on completing each period of instruction are intended not only to test the knowledge acquired, but also to excite a spirit of emulation. The results should, therefore, be made known to the cadets without delay, and should show them in order of merit.
6. At the end of the cruise the Captain, taking to his assistance the officers of the ship, will assess the knowledge and ability of each cadet in the several subjects, basing the award on his own and the officers' personal knowledge of him and on the results of the test examination. The awards will be *Very Good*, *Good*, or *Fair*, and will be recorded on a certificate which will be signed by the Captain.

* Sub-enclosures 2 and 3 (page 16).

Sub-Enclosure No. 2 to Enclosure No. 4 in Second Report of Education Committee, dated 14th June 1912.

ROUTINE OF INSTRUCTION IN THE TRAINING CRUISERS.

The cadets will be divided into three sections, which will give about 20 in each, and will work in twelve-weekly cycles, thus:

A. Group	-	-	{ Seamanship;
		-	{ Torpedo and Electrical Work;
B. Group	-	-	Engineering;
C. Group	-	-	{ Navigation;
		-	{ Pilotage;
		-	{ Gunnery.

Each section will devote two periods each of four weeks to each group of subjects.

2. The section taking the A. group of subjects will be divided into four sub-divisions of five each. Two of these will take Seamanship, while the other two take Torpedo and Electrical Work.

$\frac{3}{6}$ of the time	will be given to	Seamanship;
$\frac{2}{6}$ " " " Torpedo and Electrical Work;		
$\frac{1}{6}$ " " " Physical Drill, &c.		

Cadets belonging to the Seamanship sub-divisions will do at all times as much of the work of the ship as possible, *e.g.*, keep certain day watches, hoist all boats, run duty boats, and generally perform any officers' work that has to be done.

At sea the section taking the A. group will take meridian sights.

3. The section taking the B. group Engineering will be divided into three sub-divisions.

These sub-divisions will be arranged as most convenient for instruction, but the time devoted by each cadet to the following practical subjects should not be less than:

Steamboats	-	-	-	-	-	-	-	10 runs;
Refitting work in engine-room and stokeholds	-	-	-	-	-	-	-	48 hours;
Watch-keeping	-	-	-	-	-	-	-	54 hours.

The arrangement of engine-room watches which will enable this to be done is—

6.30 to 7.30 a.m.
8.30 to 10.0 a.m.
10.0 to 11.15 a.m.
Noon to 2.0 p.m.
2.0 to 4.0 p.m.
4.0 to 6.0 p.m.

Under the supervision of the engineer officers practical examples on the heat and steam syllabus of the training colleges and on the subject matter in the cruisers' engineering syllabus should be worked out, and also practical examples in Applied Mechanics based on problems in connection with the ship's structure, machinery, or fittings.

4. The section taking the C. group will be divided into three sub-divisions of six or seven each.

$\frac{6}{12}$ of the time	will be devoted to	Navigation under the naval instructor;
$\frac{2}{12}$ " " " Pilotage under the navigating officer;		
$\frac{3}{12}$ " " " Gunnery;		
$\frac{1}{12}$ " " " Physical Drill, &c.		

At sea this section will take sights and work the reckoning.

5. The time reckoned daily as instructional hours has been taken to include:—

$\frac{1}{2}$ hours before breakfast,
$2\frac{1}{2}$ hours in the forenoon,
$2\frac{1}{2}$ hours in the afternoon,
$\frac{8}{2}$ hours in the evening.

$5\frac{1}{2}$ hours in all,

and provides for two half holidays a week.

Sub-Enclosure No. 3 to Enclosure No. 4 in Second Report of Education Committee, dated 14th June 1912.

SYLLABUSES OF INSTRUCTION IN THE TRAINING CRUISERS.

A.

SEAMANSHIP.

Rule of the Road.—Knowledge of all Board of Trade Regulations for avoiding collision at sea, including lights carried by all vessels.

Signals.—Semaphore Morse Flags and their meanings. Signal Manual, pages 1 to 4, 39 to 41, 65 to 67, all inclusive.

Anchor Work.—Names and uses of all gear in connection with anchor work in the service. Terms and definitions used in anchor work. Weighing and letting go single anchor. Laying out a kedge anchor. General idea of mooring and unmooring.

Boats.—Handling boats under steam, sail and oars. Lowering and hoisting boats. Securing sea boats.

Rigging. Knowledge of tackles, blocks, hawsers, purchases and boats' falls. Advantages gained by tackles. Bends and hitches and splicing. Rigging a derrick for coaling purposes.

Organisation.—General principles of telling off and stationing a ship's company.

Knowledge of the general principles of the Mooring Board and Battenberg.

EXAMINATIONS.

A viri voce test examination to be held on completing each period of instruction.

B.

TORPEDO AND ELECTRICAL WORK.

Preparing and running torpedoes from ships and boats. Transporting torpedoes between decks and hoisting in and out. Arrangements for picking up torpedoes.

Rigging boats' dropping gear.

Submerged tube drill.

Use of director.

Watch-keeping on switchboard. Starting and controlling motors. Shifting over dynamos.

Rigging and running temporary power and lighting circuits.

Using searchlights.

EXAMINATIONS.

A viri voce test examination to be held on completing each period of instruction.

C.

ENGINEERING.

The combustion of coal and oil and their calorific value.

The effect of heat on solids, liquids, and gases, and calculations involving their specific heat, and the relation between the pressure, volume, and temperature of gases. The formation and condensation of steam.

Defects that are in practice shown by the diagram.

Practical work with the indicator.

Principal differences between theoretical and actual diagrams for steam and internal combustion engines.

Impurities of boiler water. Reasons for avoiding sea water. Corrosion and galvanic action in boilers, and the remedies employed.

Service tests of boiler and feed water. Hydrometers.

Thermal efficiencies of boilers and engines. The density of boilers and evaporators.

Distinction between impulse and reaction turbine. General description of points of difference in action of De Laval, Parsons and Curtis turbines.

Leakage over blade tips of a reaction turbine.

Low efficiency of high pressure Parsons turbine.

Angle of elastic twist in a given length of a shaft proportional to twisting moment. Application in torsion dynamometers to measure power transmitted by a shaft.

Practical forms of torsion dynamometer used in the Service.

The laws of resistance and propulsion and the connection between speed, power, and fuel consumption.

EXAMINATIONS.

A paper test examination to be held on completing each period of instruction.

D.

PRACTICAL ENGINEERING.

Precantions to be observed and difficulties occurring when getting under way, shutting off and finished with engines. Drain and steam pipe systems, with rough sketches. Filters, feed, and distilling arrangements, with rough sketches. Defects occurring when at sea, and found on opening out. General engine-room practice and care and maintenance of machinery. Description and sketches of main engine details.

Opening out, examining, refitting and adjusting all parts of main engines and auxiliary machinery. Examining, testing, cleaning and repairing boilers. Uses of all the important main engine and boiler mountings. Pipe tracing and rough sketching.

Watch-keeping duties of Stoker Petty Officer, Engine-Room Artificer, and Engineer Officer.

Running steamboats.

General arrangements of auxiliary machinery.

EXAMINATIONS.

A viri voce test examination to be held on completing each period of instruction.

E.

HULL AND FITTINGS OF SHIP.

Materials used in construction and where used. Outline section through an armoured cruiser. General knowledge, not detail dimensions of inner and outer bottom plating, deck beams and connections, longitudinal and traverse frames. Armour, its position and attachment - protective decks. Engine bearers. Coal fittings and arrangements. Coal bunkers. Where watertight bulkheads are fitted. W.T. doors - their construction, how and where worked. Ventilating arrangements. Pumping, drainage and flooding arrangements, including fire mains. Pipe tracing and rough sketching.

EXAMINATIONS.

A *vivā voce* test examination to be held on completing each period of instruction.

F.

NAVIGATION AND NAUTICAL ASTRONOMY.

Position line of latitude by meridian altitude of sun, star, or planet.

Latitude by pole star.

Meaning of position line generally. Position line by altitude of sun, star, moon, or planet.

Use of a single position line in conjunction with dead-reckoning.

Fix by one position line and bearing of distant object.

Fix by two position lines taking account of distance run between the sights. (Cadets to make their own plotting chart.)

Deviation by time azimuth (sun or star).

Use of azimuth tables.

Error and rate of chronometer (by sun or star).

Easy time problems. Proofs of (i) S. Std. time = S.M.T. + R.A.M.S.; (ii) Star's H.A. - S.M.T. + R.A.M.S. = R.A. Star. Time of meridian passage of stars.

Easy scouting problems.

Easy problems on sunrise, sunset and twilight.

EXAMINATIONS.

A paper test examination to be held on completing each period of instruction.

G.

PRACTICAL NAVIGATION.

Corrections of courses and bearings.

Laying these off on the chart, including allowance for current.

Fixing ship's position by cross bearings; by two bearings of a shore object and the run in the interval; four point bearings.

Fix by bearing of an object and vertical angle.

Sun, star, planet and moon sights worked by the "New Navigation" method.

Latitude by sun, or star, meridian altitude.

Latitude by pole star.

Fix by two observations of heavenly bodies, allowing for run; by one observation of a heavenly body and the bearing of a shore object.

True bearing and distance of a place by Mercator's Sailing.

(The above to be done on a chart, and all positions to be obtained by plotting on the chart.)

EXAMINATIONS.

A paper test examination to be held on completing each period of instruction.

H.

PILOTAGE.

Different kinds of compasses.

Methods of fixing by compass, practically taking bearings and fixing, and laying off courses. Reading charts.

Keeping navigating officer's note-book.

British system of lighting, buoyage and fog signals.

Tides and use of tide tables.

Winding and comparing chronometers.

Instruments, patent logs and sounding machines.

Writing up log.

Compass deviation. Causes and correction.

EXAMINATIONS.

A test examination to be held on completing each period of instruction, *vivā voce* in all subjects except the last, which is to be a paper one.

I.

GUNNERY.

Sighting.—Short description of a modern sight and its requirements. Sight setting. The use and care of telescopes.

Shooting.—Instruction in aiming appliances. Firing with aiming rifle and 12-pdr. or 3-pdr. guns.

Gun Drill.—To know the duties of any number at a 6-inch casemate or 12-pdr. Q.F. gun, and to be able to take charge of and drill a gun's crew. (Cadets should be placed in charge of gun's crews of seamen.)

Rifle.—Drill and firing exercises. (These should be thoroughly taught and cadets made to drill and instruct classes in order to learn to "take charge.")

Pistol.—To be able to use safely. (Cadets should not be taught pistol drill or examined in it.)

EXAMINATIONS.

A *viru voce* test examination to be held on completing the instruction in each subject.

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Enclosure No. 5 in Second Report of Education Committee, dated 14th June 1912.

CERTIFICATE ON LEAVING TRAINING CRUISER.

This is to certify that Mr. _____, Naval Cadet, has been through a course of training on board this ship. His knowledge and ability are:—

In Seamanship: _____
In Engineering: _____
In Navigation: _____
In Pilotage: _____
In Gunnery: _____
In Torpedo and Electrical Work: _____

He has shown _____ attention to his work, and his conduct has been _____.

Given on board His Majesty's Ship _____ this _____ day of _____ 19_____.

Captain.

—
Enclosure No. 6 in Second Report of Education Committee, dated 14th June 1912.

EXTRACT FROM FORM E. 190.—RECORD AND CERTIFICATES OF MR. _____ DURING HIS SERVICE AS NAVAL CADET, MIDSHIPMAN AND SUB-LIEUTENANT, INCLUDING RESULTS OF THE EXAMINATION FOR THE RANK OF LIEUTENANT.)

Number on Books of R.N. College, Dartmouth

In Pursuance of the Orders of the Lords Commissioners of the Admiralty,
Mr. _____

FROM _____ TO _____

Naval Cadet, borne on the books of:

Royal Naval College, Osborne - - - - -
" " " Dartmouth - - - - -

has been examined in the subjects of the authorised curriculum, and is entitled to a
Class in the Subjects of College Course,

His conduct under training has been satisfactory.

He can swim.

He receives the following allowance of sea time in months:

Date of Birth - - - - -
Date he should be rated midshipman - - - - -
Date he should pass for the rank of lieutenant, }
 provided he has completed his sea time - - - - - }
Date to be advanced to sub-lieutenant - - - - -

Captain,
R.N. College, Dartmouth.

Date

Third and Main Report.

COMMITTEE ON EDUCATION.

ADMIRALTY, S.W.,

SIR,

13th September 1912.

In compliance with your letter C.W. 11589, dated 26th March 1912, in which you conveyed the directions of the Lords Commissioners of the Admiralty to inquire into the education and training of Naval Officers of the Military Branch, the Committee have examined the subjects referred to in the Terms of Reference and now submit the following report:—

ENTRY.

2. The entry of naval cadets and their subsequent training while in this rank are governed by the *Regulations for entry of naval cadets*, dated June 1909 (page 37), by *Physical requirements for candidates for commissions in the Royal Navy*, dated July 1911 (page 40), and by *Regulations respecting cadets while at the Royal Naval College at Osborne and Dartmouth and on board the training cruisers*, dated 12th September 1908 (page 41). These regulations have been revised and consolidated in *Regulations for entry and training* which are now submitted, and will be found on page 46. The regulations for the entry into the Royal Naval College at Dartmouth of cadets from the "Conway" (page 53) will remain unaltered.

3. The applicant for a cadetship does not need any nomination, but is required—

- (1) to present himself for medical examination; and
- (2) immediately after that to appear before a committee, which interviews each boy separately.

The Interview Committee consists of—

- (1) a flag officer;
- (2) a captain, Royal Navy;
- (3) a head master of a public school, or, occasionally, some well-known educational authority connected with preparatory school work;
- (4) a member of the First Lord's Private Office, who acts as member and secretary.

4. The interviews are held twice a week during February, June and November. After being medically examined the candidates are interviewed separately, and the confidential reports furnished by the masters of their schools are examined. The Interview Committee classify the candidates, and the selection of those to take the qualifying examination is based on the classified list, those rejected on medical grounds—usually about 18 per cent.—having been first eliminated.

5. To meet cases in which the parent or guardian of a candidate is not satisfied with the result of the official medical examination, the Committee propose to institute the medical Board of Appeal favoured by the medical director-general, *see* clause 5 of the amended *Regulations for entry and training* (page 46).

6. The qualifying examination is conducted by the Oxford and Cambridge Schools Examination Board, is held about three weeks after the last interview, and lasts two days. It is in no sense of the word competitive and is only meant to ensure that the candidate is reasonably well advanced for his age and shows capacity to go further.

7. From the first it has been recognised that, whatever system of selection is adopted, some of the boys chosen would prove to be unfitted for a naval career, and arrangements were made to "weed" them out, more especially at the end of the first year at Osborne College. The numbers "weeded out" from the early entries reached about 10 per cent., but from the later ones have fallen to not more than three or four per cent. The waste from other causes while at the colleges and in the cruisers has

been less than 2 per cent. per annum. The causes of the reduction in the numbers weeded are not clear. Although the standards of the different entries fluctuate considerably, the head masters both of Osborne and Dartmouth Colleges—Mr. C. Godfrey and Mr. C. E. Ashford—believe that the general standard has not altered. Mr. Percy Matheson, secretary of the Oxford and Cambridge Schools Examination Board, which conducts the examinations, stated in evidence that the qualifying examination had been made shorter and simpler, but not more stringent. On a careful review of the whole question the Committee are inclined to believe that the "weeding" process has been somewhat too much relaxed. A little more stringency would have a beneficial effect, and would tend to raise the prestige of the colleges, to elevate the standard of the backward cadets, and to reduce the number of inefficient officers in the Navy.

8. The evidence given before the Committee has been much in favour of the system of entry embodied in the interview committee and the qualifying examination. It is true that some boys of somewhat low ability are entered. This is believed to be due, not to any failure in the system of selection, but to an insufficient number of suitable candidates. Mr. W. W. Vaughan, the head master of Wellington College, who has served on an interview committee, stated in his evidence that he was struck with the limited number of good candidates, and that he was disappointed at having to accept some weak boys. In this opinion he is supported by a number of other witnesses, who seemed to believe that the Navy has not been getting as large a supply of good candidates as it should. The presence of a tail of very weak ones among those selected is borne out by Captain the Honourable Horace Hood of Osborne College, who was emphatic in his evidence that some of the boys were deficient in intelligence and unfit to become naval officers. The head masters both of Osborne and of Dartmouth Colleges are agreed that the best and average cadets are much on a par with the best and average boys of the same age at public schools, but that the worst are too much below the average, although not so bad as the worst at the public schools. The evidence from the training cruisers, and to a less degree from the seagoing fleet, confirms the view that a certain proportion of the boys selected are much below the desirable standard.

The only effective way to reduce the number of weak cadets will be to increase the number of candidates from whom selections are made. At each examination held during the past five years the number of entries has averaged about 70 and the number of candidates about 175, from whom have been taken, as is believed, nearly every suitable boy and in some cases doubtful ones. It is evident that the increased entries required for the larger navy of the future demand an addition to the number of suitable candidates.

9. The supply of suitable candidates may be adversely affected in several ways :—

- (a) The parents may erroneously believe that a nomination for a cadetship is still required and be deterred from applying by the supposed difficulty of getting one ;
- (b) The parents may dislike to bind their sons down at the early age of 13 to undertake to serve in the engineering or other special branch on attaining the rank of lieutenant ;
- (c) The parents may have been led to believe, quite wrongly, that the life at Osborne is too strenuous and is injurious to health ;
- (d) The expense may be too great for the means of the parents ;
- (e) The preparatory schoolmasters may not exert a favourable influence.

10. To meet these objections the Regulations for entry have been revised as shown on page 46 :—

- (a) Is met by clause 1, which declares that no nomination is necessary.
- (b) The undertaking referred to in clause 3 of the *Regulations for entry*, dated June 1909 (page 37), is thought to be no longer necessary. Cadets entering now will not specialise until about nine years from the date of entry, by which time the general attitude of the navy towards engineering will probably have changed. The extra pay of 4s. to 10s. a day is believed to be sufficient to attract volunteers.

(c) The hours of work in each week, including "preparation" and a period of religious instruction on Sundays, are $38\frac{3}{4}$ at Osborne and $43\frac{3}{4}$ at Dartmouth, which are only slightly more than the regular hours of work at schools in general for boys of corresponding ages, but the work is varied and much of it is practical, not involving mental strain. The Committee are of opinion that the school work is not excessive, and in this view they are supported by the report of the Inspectors of the Board of Education, p. 84.

(d) The average cost to his parents of a cadet at Osborne is about 93*l.* per annum (page 51). If travelling expenses and clothing are added, the sum may well rise to upwards of 110*l.* The cost of a cadet's outfit, as detailed on pages 50 to 52, averages about 60*l.*

These expenses are reasonable as compared with those at the public schools; higher than some, lower than others. But two considerations show that they are more than can be afforded by the parents of many suitable boys. First, the public schools are well provided with scholarships which reduce the cost by anything up to 100*l.* a year. Second, and perhaps even of more importance, a great number of boys are not sent to boarding schools at all, but live at home and attend day schools. The cost is then on an altogether different scale, even when it is not further reduced by scholarships, as is often the case. Among these boys, who get their education at comparatively trifling cost, are to be found some of the ablest in the country, and many others who from parentage, early training, ability and character are eminently suitable for the Navy. To many of them the normal fees of a boarding school are absolutely prohibitive. Further, it should be noticed that the cost of the colleges to the parents is at least 35*l.* per annum higher than was that at the Keyham Royal Naval Engineering College.

Some recognition has already been given to these considerations in the reduction of fee now allowed to certain cadets whose fathers are, or were, in the navy, army, or marines, or in the civil service under the Admiralty (see page 39, paragraph 12). The Committee propose that the principle should be extended by lowering the fees to 24*l.* per annum in respect of a number not exceeding 20 per cent. of the entries at each examination and by not limiting the reduced scale to the sons of officers in the navy, army, and marines, and of civil servants under the Board of Admiralty.

Applications for the reduced fee would have to be made before the interview, instead of after selection as at present (page 48, paragraph 13).

In selecting for this reduced scale their Lordships would have regard to the pecuniary circumstances of the candidates, but the Committee recommend that no candidate should be admitted on the reduced scale unless he passes the qualifying examination with some credit.

This reduced fee of 24*l.*, coupled with the high standard of the education given at Osborne and Dartmouth, would compare favourably with that of 20*l.* paid by a scholar at Winchester College for an education which costs others 120*l.* Both the number and quality of the candidates should be raised by these reduced fees, which should attract boys of ability. After making allowance for those paying the present reduced rate of 40*l.* per annum, who in the midsummer 1912 term numbered about 7 per cent. of the whole, the additional charge to the nation would approximate to 8,000*l.* a year with 1,000 cadets under training.

(e) The preparatory schoolmaster finds that it is not to his interest to send boys into the navy at the age of $12\frac{1}{2}$ to 13. Quite naturally he prefers to keep them until they have risen to the top of his school and are at least $13\frac{1}{2}$, which is about the age at which they leave him for a public school. He is, therefore, constantly pressing to raise the age by eight months. The objection to raising the age on entry is that to do so delays the dates of going to sea and of promotion to the rank of lieutenant. The Committee have proposed certain reductions in the time of training, which in their judgment are the maximum possible. Even after these are in force the age on joining the seagoing fleet will be upwards of 17, and the time from entry to lieutenant being about nine years, the age on promotion to that rank will be for the majority about 22.

A further reason against raising the age is that the education and training at Osborne are so much superior for the purposes of the navy to that of the majority of schools that it is a gain to get the boys there early. The inducement to raise the age, usually held out, is that a larger number of suitable candidates would come forward; but of this no proof is forthcoming and none appears to be obtainable. After careful consideration the Committee advise that the age of entry should not be raised, but should remain as at present, viz., between 12 years and 8 months and 13 years.

11. The Committee take the opportunity to record their appreciation of the assistance they have received in dealing with this part of the inquiry both from the Association of Preparatory Schools and from the head masters of certain public and private schools.

THE COLLEGES.

12. In compliance with their Lordships' request, conveyed in Admiralty letter C.E. 11845 of 2nd April 1912 (page 54), the Board of Education were pleased to allow their officers to inspect the colleges at Osborne and Dartmouth. The report of the inspectors (page 55), as the considered judgment of gentlemen experienced in education, is valuable, will repay close attention, and removes the necessity for any detailed report from this Committee. It will suffice to say that the course of instruction extends over a period of four years, divided equally between Osborne and Dartmouth. In each year are three terms, each of about 13 weeks. In July 1912, at Osborne, the total number of cadets was 439, and the number in each term varied from 65 to 80; at Dartmouth the total was 406, and each term included from 63 to 71. The syllabuses have been constantly revised, to bring them more into accord with the special requirements of the cadets. Those now in force are dated March 1912, and will be found on page 72.

13. On the whole the inspectors were favourably impressed by the system of instruction and examination. In English and history the cadets are taught by picked masters such as would be rarely found teaching boys of the same age at a public school, and, consequently, they receive a better liberal education than the average boys on the modern side of such schools. In the first-named subject "the work appears to be "singularly successful in teaching the cadets to express themselves in clear and "vigorous English, and in inspiring them with a taste for reading."

The work in the geography department at Osborne created a most favourable impression. In modern languages the report is not quite so favourable, and a certain want of co-ordination between the work at Osborne and Dartmouth is noted. In mathematics the inspectors noted that a wide departure has been made from the teaching traditional in English schools, but as is believed with good results; that at Dartmouth provision is made for the abler boys to go further than the others, while at Osborne this is only the case to a very small extent and thus some boys are unable to keep up. On the whole, the work of the better boys is held to be very good, and the general average to be high.

Of the science work the general impression left on the inspectors was that it reached a very satisfactory level, and compared very favourably indeed with the work done by boys of the same ages in any other schools in the country.

In engineering the amount of what may be termed theory is small, but is compensated to some extent by the practical work, which was held to be extraordinarily good and better than that done in any other school or college of any kind.

Of the work in the drawing office the inspectors report that "there is nothing to learn from the best technical colleges, since in few of these are such sound methods so consistently adopted."

14. The Committee desire to point out that the education at the colleges differs from that previously given to naval officers in this country in the large amount of time and attention devoted to practical mechanical work, in the improved methods of instruction in mathematics and science, and, above all, in the stress laid on the study of English and history, which provide the liberalising influence on the mind required as a counterpoise to the narrowing effect of naval and mechanical technicalities. They are convinced that the education at present given at Osborne and Dartmouth Colleges is of a high order, and that both the courses of instruction and the system of examination are satisfactory. They have made careful inquiries to ascertain whether the time spent at the Colleges can be reduced, and are satisfied that it cannot without very seriously impairing the instruction. This remark applies more or less to every

department, to the humanities, to mathematics, to science, and especially to engineering, which, although it absorbs about one-fourth of the whole time, provides only the equivalent of twenty working weeks of an engineering apprentice for work in the shops.

15. The only change which the Committee recommend in the curriculum at the colleges is an addition to the time allotted to navigation, sufficient to compensate for the reduction of time in the training cruiser from eight months to four. This means the transfer of work, to which 80 hours is now given, from the training cruiser to Dartmouth, an addition which will necessitate a reduction in some other subjects. In the judgment of the Committee this reduction should not be made either in the humanities or in engineering. A possible way of adjusting the requirements of the several subjects is shown on page 100, submitted to the Committee by the head master of Dartmouth and approved by the captain of the college.

THE TRAINING CRUISERS.

16. In the second report the Committee recommended that the two training cruisers of the "Cornwall" class should be retained for the present, but that certain changes should be made in the instruction, with a view to render the cadets better fitted to take part in the work of a seagoing ship. Their Lordships have been pleased to approve this recommendation. Assuming that the proposals now made (paragraph 15) to increase and improve the instruction in navigation at Dartmouth College are accepted and brought into operation in January, 1913, and in view of the improved training in the fleet now proposed, also of the desire to reduce the age for promotion to the rank of lieutenant, the committee recommend that the time allotted to the cruiser shall be reduced from eight months to four—24 working weeks to 12—in January 1915. This interval is required to permit the necessary readjustments at Dartmouth to take effect.

The advantages of this reduction in the cruiser time will be:—

- (a) The cadets in each entry will be divided between the two cruisers, and the reduced numbers in each ship will render the instruction more effective;
- (b) Any future increase of numbers in each entry can be accommodated;
- (c) Officers will reach the ranks of acting sub-lieutenant, sub-lieutenant and lieutenant four months earlier;
- (d) The lieutenants' lists will be automatically increased;
- (e) Smaller ships can then be substituted for the armoured cruisers.

THE TRAINING AT SEA.

17. The first "entry" of cadets under the new scheme went to sea as midshipmen in the fleet in May 1908. Their training at sea was regulated by circular letter No. 51, dated 1st May 1908 (page 101), which directed that it was to last three years, and to be carried out wholly on professional lines, designed to enable them to obtain a thoroughly practical knowledge of their profession. They were to work for successive periods with the executive, gunnery, torpedo, navigating and engineer officers, who were made responsible for their training and instruction. The evident intention was that they should learn their work by doing it. To further that end compulsory school was abolished on the perfectly valid plea that they had received a sufficient education in school subjects. Several causes combined to render the intention nugatory. Among them perhaps the principal ones were the character of the syllabuses for the examination for the rank of lieutenant contained in the appendix to circular letter No. 51 of 1908, and the accelerated promotion offered to those who devoted their time to theoretical subjects. As has been explained in our first report, both causes combined to divert the attention of midshipmen from learning the work which they would ultimately have to do as lieutenants. Other causes have been the wrong direction given to the training in the cruiser, to which attention has been already called in our second report, and the constant shifting from ship to ship, which was so frequent that in the three years each midshipman on the average served in five or six ships. These frequent changes impaired their training by discouraging the officers of their ships from taking an interest in them. A further cause was the retention of the naval instructor, who was continued (a) to superintend the taking of sights, (b) to assist the specialist officers with the theoretical instruction, and (c) to encourage voluntary study. In the judgment of the Committee

these purposes are insufficient to justify the presence of a naval instructor on board a seagoing ship, in view of the fact that cadets have already received a sufficient education in school subjects at the colleges. The result has been that the majority of midshipmen have taken little part in the practical work of their ships, and that a considerable portion of their time and energy has been diverted to lectures and study, to prepare for examinations which have included a great deal of matter not necessary for a lieutenant to know.

18. In the above quoted circular letter No. 51 of the 1st May, 1908, the system of training had been left vague, except in the important proviso that about one-third of the time should be devoted to engineering. As a necessary consequence the training varied greatly in different ships. This would have mattered little if the midshipmen had remained in the same ship under the same officers and the examinations had been limited to ascertaining whether they had a reasonable knowledge of the practical duties of their profession, but, as the midshipmen were constantly removed from ship to ship, the result was necessarily serious. In order to secure some uniformity circular letter No. 25 was issued on the 10th May, 1910, and has since been embodied in Article **293A** of the King's Regulations (page 113). This order incidentally increased the removals from ship to ship, because naval instructors were borne in some ships but not in others, and the absence of a naval instructor was held to act unfairly in view of the nature of the examination in prospect. That part of the order, however, which dealt with engineering was based on the sound idea that the training was to consist chiefly in taking part in the daily engineering work of the ship and set forth in some detail and on sound lines the system to be followed. Those parts which related to the other specialities were left vague and unsatisfactory, and the training in the different ships still continued to vary.

19. The chief factors in the training are the personalities of the flag officers, of the captains and officers of the ships, and of the midshipmen themselves - all varying a great deal. In navigation and pilotage the training in many cases falls short of what it should be. It is essential that the navigation should be so taught in the colleges and training cruisers that, on joining the fleet, midshipmen will not require further instruction, but will only need to perfect themselves by constantly taking observations and working out examples in a systematic way. They will thus gradually train themselves to fix the ship's position with accuracy and rapidity. The greater attention paid to the subject at Dartmouth College, the revision of the syllabus in the training cruiser proposed in our second report, and the abolition of voluntary subjects proposed in our first report, already approved, should give improved results, provided that the instructions embodied in paragraphs 12, 13, 14, 15, and 16 of the Regulations for training junior officers (pages 127, 128) are carried out. Pilotage can only be learnt by practice. The evidence shows that even in a flagship, *e.g.*, the "Dreadnought," any difficulties there may be in giving midshipmen opportunities to learn can be overcome if proper arrangements are made.

20. In all departments there seems to have been a disinclination to place midshipmen in positions of responsibility and a disposition to underrate their capabilities. In engineering the evidence of the engineer officers, sub-lieutenants and midshipmen who have been examined shows that in certain ships the midshipmen have been given every opportunity and have responded well. In other ships, however, this has not been so. For instance, it appears that midshipmen in seagoing ships are seldom trusted to go away in charge of the machinery and boilers of steamboats, although they all do this before they leave the cruiser and have also had experience in running steam and motor boats while at Dartmouth College (page 119). That a midshipman should be sent away without question in charge of the boat herself, but, after the training he has received, that he should not be trusted to run her engines is an anomaly which is difficult to understand. The evidence of the engineer captain of the Second Division, Home Fleet, bears on the point. He stated that he did not think as much had been done in that Division in the way of giving midshipmen responsibility as might be done, and gave instances in support of that view. On the other hand, it should be noted that a sub-lieutenant of the new scheme, who stated in his evidence that he does not intend to specialise in engineering, kept regular officer's watch in the engine room of the "Cochrane" from Port Said to Bombay and back to England at a speed of 16 or 17 knots. The Committee do not doubt that there are other officers capable of taking the same duty if they are given the opportunity.

It is possible also that the fear lest midshipmen might be called upon to specialise in engineering against their will has also prejudiced the training. The Committee

are of opinion that it is very necessary to remove that impression and make it quite clear that volunteers only will be taken. Every officer of the military branch should have experience in the engine-room department, and be able to take charge of an engine-room watch should the need arise; but more than that is not required from those who do not specialise.

21. In gunnery the difficulties have been that the midshipmen joined the seagoing ships with very little knowledge, that under Admiralty orders all instruction was to be given them by officers and not by seamen instructors, and that the gunnery lieutenant had not time to instruct them in the subjects mentioned in the very ambitious syllabus, which covered many matters not essential for an officer of quarters. In torpedo similar difficulties have been met with. Speaking generally, the training has taken the form of too much lecturing and too little practical work in both subjects. The changes proposed in the cruiser training should improve their practical knowledge on joining the fleet, and those now proposed in the syllabuses and in the training at sea should tend to direct energy into the proper channels.

22. The Committee attach the greatest importance to the midshipmen doing real work and being given real responsibility in all departments, as has always been the custom in connection with boats. In no other way can they be trained to become officers, or be brought to work at, and to take an interest in, their profession. With this object in view the Committee have found it necessary to revise Form E. 190, which will be seen on page 120, and to prepare new *Regulations for training*, which will be found on page 126.

These latter provide—

- (a) that the midshipmen shall remain as far as possible in the same ship;
- (b) that the training shall be directed to fit them to perform the duties of a lieutenant;
- (c) that the training shall consist chiefly in taking part in the daily work of the ship;
- (d) the orders to be followed by midshipmen when working with the specialist officers.

(a) has been to some extent provided for in circular letter No. 37, dated 6th December 1911 (page 133).

23. The Committee recommend that the annual examination of midshipmen ordered by Article 294A of the King's Regulations and amended by weekly order No. 241, dated 4th August 1911 (page 135), shall be abolished.

NAVAL INSTRUCTORS.*

24. For the reasons given in paragraph 17, the Committee further recommend that on the 15th May 1913, naval instructors shall be removed from all seagoing ships, except the training cruisers, and that chaplains who act as naval instructors shall cease to do so. Page 170 shows that the total number of naval instructors and chaplains acting as naval instructors is now 60, of whom only 14 of the former and 13 of the latter are employed at sea with midshipmen. If the Committee's recommendations are approved, these 14 naval instructors will have to be otherwise employed, or retired with a gratuity, or some substantial addition to the retiring pension to which each is entitled. It is understood that some of them will be required at the Royal Naval College, Greenwich. The 13 chaplains will have to be compensated for their loss of income on ceasing to act in the dual capacity. Eventually the abolition of the naval instructor will result in some economy to the Crown. The Committee venture to urge the claims of these officers to liberal treatment, as they will be thrown out of employment through the exigencies of the Service and not through any fault of their own. (See note below).

THE EXAMINATIONS FOR THE RANK OF LIEUTENANT.

25. After passing in seamanship and attaining the rank of acting sublieutenant, officers who entered the navy prior to September 1903, went through courses at specialist schools on shore in navigation, pilotage, gunnery, and torpedo, before being examined in those subjects for the rank of lieutenant. These courses occupied nearly one year (page 135), and withdrew the officers during that time from service at sea, thus depriving them of much valuable experience. Their effect was to throw responsibility for the training on the "schools," thus discouraging work at sea; to

* It has been decided by the Board of Admiralty that the Naval Instructors now in the Service shall continue to be employed as such.

compress into a few weeks what ought to have been spread over a long period, thus fostering cramming for the examination; and to direct attention to the shore aspect, with its attendant train of irrelevant matter, rather than to the sea aspect of the subject. The candidates presented themselves to the examiners immediately after completing each course and thus displayed their knowledge in much too favourable a light, as would have probably been made evident had they been examined six months later. This is borne out by the evidence of the senior lieutenant of the gunnery school who stated that many of the present lieutenants are deficient in knowledge of gunnery. The Committee are of opinion that there is much truth in this view, and note that the officers in question have all been through the sub-lieutenants' course at the gunnery school.

26. In the year 1906 a change was made, the examination in navigation being taken immediately after coming on shore and without any preparatory course. The circular letter No. 51 of 1908,* already mentioned, went further and abolished the courses in pilotage, gunnery, and torpedo for officers (new scheme) who entered the navy in September, 1903, and later. The object was to increase the time passed at sea, where alone officers can acquire any real practical knowledge of their profession.

27. In May, 1911, the first examination of midshipmen entered under the new scheme was held at Portsmouth (page 135), under the regulations contained in circular letter No. 51 of 1908,* amended in certain particulars. The obligatory part consisted of two written three-hours papers daily for six days—four in navigation and two in each of the other subjects—followed by oral examinations, which lasted five days more. No oral examination was held in engineering, because the candidates held certificates that they had qualified in the practical knowledge of engine-room duties. The voluntary part has been dealt with in our first report and need not now detain us.

The following extracts are taken from the reports of the examiners:—

SEAMANSHIP.

“The results of the examination in seamanship are, on the whole, very satisfactory, especially when taking into consideration the severe conditions under which the whole programme of examinations has had to be carried out.”

GYNNERY.

“The new-scheme midshipman has a much greater knowledge of gunnery than the old-scheme midshipman had the new-scheme midshipman does not know as much as the acting sublieutenant of the old scheme when he presented himself for examination in gunnery at the end of his course in the ‘Excellent.’”

TORPEDO.

“The knowledge of the candidates is far superior to that of the old-time sublieutenant, and in most cases to that of non-specialist lieutenants of several years' standing.”

NAVIGATION.

“Generally speaking, they are ignorant of the practical navigation of a ship, and it is impossible not to form the conclusion that there are very few who I consider could be trusted to command a torpedo-boat and pilot her safely into the sort of harbours often frequented by such craft.”

ENGINEERING.

“The papers show that they have the requisite knowledge to carry out engineering duties at sea.”

The results of the examination were:—

				Seamanship.	Navigation.	Gunnery	Torpedo.	Engineering.
Firsts	-	-	-	-	21	3	1	8
Seconds	-	-	-	-	26	14	15	33
Thirds	-	-	-	-	6	24	26	12
Failures	-	-	-	-	Nil	12	8	Nil

The ordeal had been severe. The syllabuses of the examination were too extensive. The papers set were too numerous and not quite suitable in all cases. Sufficient allowance was not made in some cases for conditions different from those of examinations immediately after "courses." The Admiralty intended that each examining board should be responsible for awarding classes in its own subjects and should frame its own standard of marks. Owing to some misunderstanding this was not done, and on receiving the report their Lordships revised the classification as follows:—

	—	Seamanship.	Navigation.	Gunnery.	Torpedo.	Engineering.
Firsts	-	-	-	1	5	16
Seconds	-	-	-	20	26	27
Thirds	-	-	-	22	20	10
Failures	-	-	-	7	2	Nil

Before the next examination was held the syllabuses were revised (page 148), and the number of papers in navigation reduced to two; the examining boards were directed to submit the marks obtained and the classification in all subjects, except seamanship, was reserved to be settled by "the Board." The results were:—

In September 1911.

	Seamanship.	Navigation.	Gunnery.	Torpedo.	Engineering.
Firsts	14	11	6	3	9
Seconds	29	13	12	17	13
Thirds	7	22	30	28	26
Failures	—	1	2	2	2

In January 1912.

Firsts	12	9	7	10	11
Seconds	40	11	12	19	13
Thirds	10	35	44	33	39
Failures	2	10	3	3	2

The reports sent by the examiners directed attention to the limited practical knowledge shown by many of the candidates. The evidence given by those examiners who appeared before the Committee was to the effect that officers near the top of the list—say, about one-sixth—possessed a very good knowledge, that about the same proportion near the bottom were very ignorant, and that the remaining two-thirds would be reasonably competent, with experience, to do the work of the Service.

28. In circular letter No. 11, dated 30th April 1912 (page 142), directions were given that midshipmen were to be examined at sea in seamanship and navigation for the rank of lieutenant when they had completed two years and four months' seniority, and on passing were to be rated acting sub-lieutenants. The classes of certificate in both subjects were to be awarded by the examining officers. The examinations in gunnery, torpedo and engineering were still to be held at Portsmouth on completing three years' service at sea. The first examinations under this order were to be held in September 1912.

29. The principal advantage of holding the examinations at sea is that the responsibility for both training and examination is made to rest on the officers of the seagoing fleet, who alone are able to make the training effective, and whose surroundings place them in a better position than officers in harbour and shore appointments to judge the professional qualifications necessary for a lieutenant

Again, examinations always react on training or instruction. The central examination, like the shore course, tends to impair the sea-training by setting up a false ideal; whereas those held in the fleet by the seagoing officers will tend to level it up by calling the attention of officers at sea to its deficiencies. And, further, by holding the examinations afloat instead of at Portsmouth young officers will not be withdrawn from their ships, thus saving both time and expense. For these reasons the Committee recommend that all examinations for the rank of lieutenant should be held at sea. They recognise that the standards may vary, as is the case to some extent in all examinations, but they are not disposed to lay much stress on that, since each candidate will be examined by five different boards (paragraph 5, page 145).

30. The Committee's proposed *Regulations to govern the examinations for the rank of lieutenant* will be found on page 145. It will be seen that, if these regulations meet with their Lordships' approval, the examinations will be entirely oral, except two papers in navigation and one in engineering (para. 6), which will be set by the captain of the navigation school and by an officer selected by the engineer-in-chief respectively, but marked by the boards in those subjects (pages 145, 146, para. 7, 9). Under the heading "former service," ten per cent. of the marks in each examination will be awarded by the officers of the ships in which the candidates have served (page 146, para. 9). This is an extension of what is now done in the seamanship examination, and will not only add to the responsibility of the captains under whom candidates serve and of the officers in charge of their training, but will insure that their current daily work shall count when their professional value is measured in the examination.

31. The award of time will remain as laid down in Article **309A.**, King's Regulations, except that the maximum number of marks obtainable will be ten, as recommended in our first report and approved by their Lordships.

32. The examinations in gunnery, torpedo, and engineering will be held six months after those in seamanship and navigation, instead of eight as at present (page 145, para. 2). This will prevent all five examinations falling on the same date and will accelerate the time of promotion to lieutenant by two months. A provisional examination (page 146, para. 15) will be held in cases where the exigencies of the service prevent a complete one being carried out.

33. Before being advanced to the rank of lieutenant every officer will have to serve 12 months at sea as a sublieutenant, instead of six months, as at present (Article **270**, K.R., page 167). Each officer will also have to obtain a certificate (page 146, paragraph 16) that he is fit to take charge of an engine-room watch at sea and to carry out all the duties of a junior engineer officer, in addition to the certificate that he is fit to take charge of a watch on deck. It seems to the Committee that every officer should be competent to work the propelling machinery and to take charge of an engine-room watch, even though he does not intend to specialise in engineering, and that he should obtain a certificate to that effect. To require one is to do no more than to push the training given to a practical conclusion. To obtain one should not be difficult to these officers after the training they have received. The certificates have been worded to agree with paragraph 3, Article **270** of the King's Regulations. The engine-room certificate should not be called for from any officer whose seniority as sublieutenant is dated before 31st March, 1911. The midshipman's engineering certificate called for by Article **299** of the King's Regulations and amended by circular letter No. 38 of 8th December, 1911 (page 157), will be no longer required, and has been omitted in the revised Form E. 190.

34. The Committee recommend that a sublieutenant, who performs duties in the engine-room *after* he has obtained an engine-room watch-keeping certificate, shall receive additional pay at the rate of 2s. 6d. a day. This allowance is proposed in view of the fact that the officer will be no longer under training, but will be doing the duties and taking the place of an engineer officer.

35. The *syllabuses of examination for the rank of lieutenant* and the *certificates* to be awarded (page 145) have been entirely revised. The former have been much reduced as compared with those hitherto in force, and are now limited to insure merely that officers shall have a reasonable knowledge of the practical duties of their profession before being advanced. This they should have if they have taken part as

midshipmen in the work of each department in their ships. The latter have been framed to enable the examiners to assess correctly the practical knowledge of professional work possessed by the candidates.

36. The effect of the Committee's proposals on the times served in different ranks and on the ages is shown in the following tables and on pages 158, 159:—

Time served in different ranks.

		Previous to circular letter No. 11 of 30.4.12.*	Result of circular letter No. 11 of 30.4.12.	Result of Committee's proposals.
		Years.	Years.	Years.
Naval cadet in cruiser	-	0.8	0.8	0.4
Midshipman at sea	-	3.4†	2.4	2.4
Acting sublieutenant	-	—	1.0†	0.8‡
Sublieutenant	-	2.0	2.0	2.0
At sea—maximum time to rank of lieutenant	-	6.0	6.0	5.4
At sea—minimum time to rank of lieutenant	-	4.5	4.5	4.3

* Page 154.

† Includes four months delay due to passing out of college.

‡ Includes two months delay due to passing out of college.

Ages at different stages.

		Previous to circular letter No. 11 of 30.4.12.	Result of circular letter No. 11 of 30.4.12.	Result of Committee's proposals.
On joining	-	12 $\frac{1}{2}$ to 13	12 $\frac{1}{2}$ to 13	12 $\frac{1}{2}$ to 13
On leaving college	-	16 $\frac{1}{2}$ to 17	16 $\frac{1}{2}$ to 17	16 $\frac{1}{2}$ to 17
On leaving cruiser	-	17 $\frac{1}{2}$ to 17 $\frac{1}{2}$	17 $\frac{1}{2}$ to 17 $\frac{1}{2}$	17 to 17 $\frac{1}{2}$
Promotion to acting sublieutenant	-	—	19 $\frac{1}{2}$ to 20	19 $\frac{1}{2}$ to 19 $\frac{1}{2}$
Promotion to sublieutenant	-	20 $\frac{1}{2}$ to 21	20 $\frac{1}{2}$ to 21	19 $\frac{1}{2}$ to 20 $\frac{1}{2}$
Promotion to lieutenant	-	21 $\frac{1}{2}$ to 23	21 $\frac{1}{2}$ to 23	20 $\frac{1}{2}$ to 22 $\frac{1}{2}$

It will be seen that the maximum time under training will be reduced by eight months and the minimum by two months. The reduction in the maximum is made up of—

2 months by not awarding time on leaving the cruiser,

1 months by reducing the time in the cruiser,

2 months by reducing the time as acting sublieutenant.

Total 8 months.

The effect will be to increase gradually the lieutenants' list by upwards of 100 during the next seven years.

TRAINING AND SPECIALISING SUBSEQUENT TO THE EXAMINATION FOR THE RANK OF LIEUTENANT.

37. The regulations which now govern specialising are to be found as follows:—
For navigation—in Article 313 of the King's Regulations (page 160);
For gunnery and torpedo—in Article 866 of the King's Regulations (page 162) and circular letter No. 25 dated 14th August, 1911 (page 162);
For engineering—in the circular letter No. 25, dated 14th August, 1911 (page 162).

38. The amended regulations now submitted are contained in pages 164 to 167. It will be seen that the Committee propose that officers shall volunteer to specialise:—

In navigation and engineering—at any time after completing one year at sea in the rank of sublieutenant, provided they have obtained the two watch-keeping certificates required (paragraph 1);

In gunnery and torpedo—at any time after attaining the rank of lieutenant (paragraph 1).

And that they may be selected—

For navigation—after serving not less than one year at sea as sublieutenant (paragraph 5);

For engineering—after completing two years at sea as a commissioned officer (paragraph 31);

For gunnery and torpedo—after completing one year at sea as lieutenant (paragraph 21).

In determining these times the nature of the duties has been considered. In navigation less previous sea service is exacted, since the nature of the navigating officers' duties will give them experience in handling ships and their services may be required early to navigate the smaller ships. In engineering, gunnery and torpedo the *minimum* sea time required is really two years, but in the first all officers are placed on the same footing, since no regard is paid to the rank they hold while at sea, whereas in the last two those who have received accelerated promotion are at an advantage. The proposals of the Committee will make permanent the temporary measure ordered in C.W. 8594, dated 24th May, 1912 (page 168). They will also allow officers to specialise in engineering rather earlier than in gunnery and torpedo, which is reasonable, since the lieutenant (E) will not at first be head of a department.

The minimum ages at which officers will be able to specialise will be:—

In navigation—between $20\frac{1}{2}$ and $21\frac{1}{2}$;

In engineering—between $21\frac{1}{2}$ and $22\frac{1}{2}$;

In gunnery and torpedo—between $21\frac{1}{2}$ and $23\frac{1}{2}$.

39. The specialist course in navigation presents no difficulty, as the existing one, little alteration, will meet all needs; in the other subjects—gunnery, torpedo and engineering—the conditions are more complex. Two classes of specialist officers, with different qualifications, have to be found:—

Those for the fleet;

Those to fill the special appointments connected with manufacture and supply.

The former will use the weapons and machinery, of which the latter will control the supply. The two classes require different training.

40. For gunnery and torpedo the arrangements hitherto made have been that a certain number of lieutenants have been specially trained at Greenwich College and either in the "Excellent" or in the "Vernon" for a period which has varied from time to time between one and two years. Those officers who have chosen the sea career sometimes argue that much of the course is of little use to them and that everything required by a gunnery or torpedo lieutenant afloat can be learnt in a short time. The Committee are under the belief that there is much truth in this contention, and that the instruction in the schools has not always been sufficiently directed to meet the sea requirements. Those who have taken the supply line are sometimes inclined to think that they have not gone far enough. The latter fill the appointments at the "schools" and in the Admiralty, and perform duties of much importance. They go to sea at intervals, but their training and special work tend to direct their minds away from the military side of the profession to its mechanical or material side. A certain proportion turn entirely to the latter, and, giving up the sea service, flow away to shore appointments under the naval ordnance department, eventually retiring, or to private firms. It would seem that the main object should be to train gunnery and torpedo lieutenants for service at sea, but that opportunity for higher training should be given to those officers whose bent of mind is towards questions connected with *materiel*.

41. With these objects in view the Committee recommend, for all officers qualifying as gunnery or torpedo lieutenants, a six months' course at the Royal Naval College, Greenwich, followed by an eight months' course, including leave, in the "Excellent" or "Vernon"; the former to be so arranged as to be a preparation for the latter, and the whole training at both places to be strictly limited to what is essential for a lieutenant (G) or (T) in a seagoing ship; those who qualify, to be divided into two classes and to receive different rates of pay (page 161). The Committee leave the

details of the courses at the Royal Naval College, Greenwich, and at the gunnery and torpedo schools to be settled within the above limits by such officers as their Lordships may direct to undertake the duty.

42. To give an opportunity for higher training to those officers whose bent of mind lies in that direction, the Committee recommend that a limited number of lieutenants (G) and (T) first class, being volunteers, shall be selected and sent to the Royal Naval College, Greenwich, for an advanced course of six months, but that, as an examination is calculated to prejudice their work, none shall be held at the end of the course and no increase of pay shall result from it. Those officers who complete this course will be designated lieutenant (G†) and (T†) respectively.

43. Engineer officers entered previous to the year 1903 were trained at Keyham Engineering College for a period which was gradually reduced from six to four years, at the end of which a proportion were sent to sea, while the more promising ones went to the Royal Naval College, Greenwich, for one year before going afloat. The distinction between the requirements for the sea service and those for the special shore appointments was recognised in that a very limited number were selected at the end of the first year to undergo a further two years' course at Greenwich.

44. For the officers entered under the scheme of 1903 the Committee recommend that those who desire to qualify in engineering for lieutenant (E) shall pass through a course of study lasting six months at the Royal Naval College, Greenwich, followed by a practical course lasting approximately one year, including leave, at Keyham College; the former to be a preparation for the latter, and the whole training at both places to be strictly limited to what is essential for a lieutenant (E) in a seagoing ship; those who qualify to be divided into two classes and to receive different rates of pay (page 164). The Committee leave the details of the courses at Greenwich and Keyham to be settled within the above limits by such officers as their Lordships may direct to undertake the duty. After this training these officers will be competent to perform engineering duties at sea.

45. To provide officers fully competent to fill positions on the engineering staff required for special employment, *e.g.*, at the Admiralty, in H.M. Dockyards, &c., the Committee find that a course of instruction beyond that given to lieutenants (E) will be necessary. It is on these officers that the engineer-in-chief must largely rely to assist him in dealing with questions relating to the design of new propelling machinery and other engineering problems. From these same officers also will be selected the engineer managers of H.M. Dockyards and their assistants. Hence they must be not only thoroughly practical, but must also have a complete knowledge of the principles and theory of heat engines, be fully competent to deal with all questions of machinery design, and have the necessary knowledge to enable them to discuss problems of naval engineering on equal terms with the specialists of the large engineering and shipbuilding firms. To maintain the required standard of professional knowledge, the officers, who have to carry out these important duties, will have to devote their whole future career to engineering and will not be able to master the many difficult and complex problems connected with the military side of the naval profession. Again, during the greater part of their service in the navy they will hold shore appointments, and will have very little sea experience indeed outside the engineering department. Hence they will not be able to carry out efficiently their important engineering duties and remain competent to perform military duties. The Committee are of opinion that they should cease to perform these latter on completing the proposed additional course of study at the Royal Naval College, Greenwich, and should at the same time become no longer eligible to take military command.

46. For the above reasons the Committee recommend:—

- (1) That from among those who have qualified for lieutenant (E) a selection be made of a limited number of officers, who will devote themselves to engineering with a view to qualifying for the higher technical and administrative engineering appointments at the Admiralty and in the dockyards; that these officers undergo a further two years' course of training at the Royal Naval College, Greenwich; that the selection of officers for this course be governed by the results of the examinations in the previous courses and by the recommendations of the officers of Keyham College; that officers selected for the long course be appointed to seagoing ships during the interval between the sessions:

- (2) That lieutenants (E) who successfully pass the examination at the end of the two years' course be designated lieutenant (E†) and proceed to sea for a period of not less than one year, after which they will be available to take up special duties on shore;
- (3) That all officers (E†) be placed on a separate list on the navy list and be not eligible to take military command;
- (4) That officers on this list be promoted by selection to commander (E†), captain (E†), and to flag rank.

47. Art. **269**, Clause 2, of the King's Regulations (page 168) provides that all Officers who have joined the Navy after January 1903, shall be required at some time after attaining five years' seniority to pass a qualifying examination for the rank of Commander in the following subjects:—

Court Martial procedure ;
 International Law ;
 Knowledge of British and Foreign Warships, Guns, Torpedoes, &c. ;
 Naval History ;
 Signals ;
 Strategy ;
 Tactics and Battle Formations.

The reason for holding this examination seems to be misunderstood. The Committee apprehend that its purpose is not to determine the officers who shall be promoted to the rank of Commander, but to ensure that no officer shall be advanced who has not a reasonable knowledge of the subjects named. An officer's promotion should depend on the way he performs his duties and on the judgment formed of him by those under whom he has served. The examination should in no way alter or affect that judgment beyond indicating that the officer has, or has not, qualified in these particular subjects. In no sense of the word should the examination be made competitive. Great care should be taken to reduce to a minimum the danger of cramming for it. If properly conducted, the examination will to some extent tend to direct attention to questions connected with the conduct of war and to foster the study of History, already begun at the Osborne and Dartmouth Colleges.

The Committee do not propose to revive the essay on Naval History, which formed part of the examination for the rank of lieutenant.

48. But something more is required. As has been already pointed out, questions connected with the manufacture and supply of weapons and electrical apparatus have tended to divert the minds of officers from the military side of their profession. The increased attention now given to machinery will add to this tendency, which may become a serious danger if some counterpoise is not introduced. It is most necessary that Officers should recognise that such matters are only a means to an end and not the end itself; that they must be viewed in their true proportion and assigned to their proper position. It would seem that the best way to bring this about will be found in giving increased facilities for the serious study of the Military side. Some effect has already been given to this view in circular letter No. 10 of 11th March, 1912 (page 168), but its effect seems to be limited to educating officers for a War Staff. The Committee venture to point out that the military knowledge referred to is required by all officers in command of ships, whether ships of the line or small craft, since any one of them may be, and often is, detached; the commanding officer then has to deal with questions on his own responsibility. Again, there are officers who would gladly avail themselves of the opportunity to prosecute their studies in this direction, if, on concluding them, they could return to active service in command or otherwise, but would be averse to serving on the staff. For these reasons the Committee recommend that the course at the War College referred to in the circular letter quoted should be directed to prepare officers not only for a staff but for command, and that the number attending should be increased, and should include commanders. If the course is really good and renders officers better fitted for command, they will be attracted to it, and no additional incentive will be required. The Committee also desire to point out that if the War Courses were transferred from Portsmouth to the Royal Naval College, Greenwich, the officers attending could be accommodated in the building, instead of living out as at present, and would be brought into closer touch with each other, which would give increased facilities for mutual instruction and make the courses more effective.

* * * * *

In conclusion, the Committee desire to place on record their appreciation of, and to draw their Lordships' attention to, the very valuable assistance they have received from Fleet Paymaster Victor H. T. Weekes, R.N., who has performed the laborious duties of Secretary in a very efficient manner.

We have the honour to be,

Sir,

Your obedient servants,

REGINALD CUSTANCE	-	-	Admiral (Chairman),	Members,
R. E. WEMYSS	-	-	Rear-Admiral,	
VICTOR STANLEY	-	-	Captain,	
R. B. DIXON	-	-	Engineer Commander,	
W. C. FLETCHER	-	-	Chief Inspector of Secondary Schools,	

VICTOR H. T. WEEKES, Secretary.

The Secretary of the Admiralty.

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*Third and Main Report, dated 13th September 1912,
addressed by the Education Committee to the
Admiralty.*

SCHEDULE OF ENCLOSURES.

Number of Enclosure.	Date and Number (if any).	Subject.
1	June 1909	Regulations now in force for entry of naval cadets.
2	July 1911	Physical requirements for candidates for commissions in the Royal Navy now in force.
3	12 September 1908	Regulations now in force respecting cadets at the Royal Naval Colleges and on board the training cruisers.
4	—	Naval Cadets: Regulations for entry and training as proposed by the Committee.
5	December 1908	Regulations now in force for the entry into the Royal Naval College at Dartmouth of cadets from the "Conway."
	*	*
7	9 July 1912	Average cost per annum to his parents of a Cadet at the Royal Naval College, Osborne.
8	2 April 1912, C.E. 11815	Admiralty letter asking Board of Education to allow their officers to inspect Royal Naval Colleges.
9	—	Report of the Board of Education Inspection of the Royal Naval College, Osborne, on 21st to 24th May, and of the Royal Naval College, Dartmouth, on 27th to 30th May 1912.
10	March 1912	Syllabus of subjects of instruction at the Royal Naval Colleges, now in force.
11	15 July 1912	Table showing the time allocated to the various subjects at the Royal Naval College, Dartmouth.
12	—	Proposed re-arrangement of the time given to certain subjects at the Royal Naval College, Dartmouth.
13	14 August 1912, C.E. 8661/12	Admiralty approval of recommendations made in Committee's Second Report.
14	1 May 1908, Circular Letter 51	Training and examination of junior officers.
15	Article 293A, King's Regulations, 1906.	Do. do.
16	—	Orders now in force at Royal Naval College, Dartmouth, for cadets in motor boats and steam boats.
17	Form E. 190	Form of record and certificates of an officer during his service as naval cadet, midshipman, and sub-lieutenant, as amended by the Committee.
18	—	Regulations for the training of junior officers, as proposed by the Committee.
19	6 December 1911, Circular Letter 37.	Appointment of midshipmen.
20	Article 294A, King's Regulations, 1906, and Weekly Order 241 of 4 August 1911.	Annual examination of junior officers afloat: regulations at present in force.
21	—	Courses to be taken prior to passing for the rank of lieutenant—in the year 1902, and later.
22	March 1911, C.W. 3010	Arrangements for the examination for the rank of lieutenant held in May 1911.
23	4 August 1911, Weekly Order 246 18 August 1911, Weekly Order 258. 1 September 1911, Weekly Order 270.	Arrangements and syllabuses for the examination for the rank of lieutenant.
24	30 April 1912, Circular Letter 11	Seamanship and navigation examinations for the rank of lieutenant to be held afloat, and midshipmen to be rated acting sub-lieutenant on passing.
25	—	Regulations to govern the examinations for the rank of lieutenant, as proposed by the Committee, also syllabuses of examinations and certificates to be awarded.
26	Article 309A, King's Regulations, 1906.	Scale of marks for promotion now in force.
27	29 May 1912, C.W. 8608	Admiralty approval of recommendations made in Committee's First Report.
28	Article 270, King's Regulations, 1906.	Qualifications now required for promotion to the rank of lieutenant.
29	5 February 1912, Circular Letter No. 6.	Engine-room training after passing for the rank of lieutenant.

Number of Enclosure.	Date and Number (if any).	Subject.
30	—	Deck and engine-room watch-keeping certificates, as proposed by the Committee.
31	8 December 1911, Circular Letter 38.	Midshipmen's engineering certificate. Regulations now in force.
32	—	Comparative table of ages at different stages, old and new schemes.
33	Article 313, King's Regulations, 1906.	Pilotage and navigating duties. Regulations now in force.
34	Article 866, King's Regulations, 1906.	Gunnery and torpedo duties. Regulations now in force.
35	11 August 1911, Circular Letter 25.	Training of officers after passing for the rank of lieutenant. Regulations now in force.
36	—	Regulations for specialising as proposed by the Committee.
37	24 May 1912, C.W. 8594	Specialisation of officers in engineering. Regulations at present in force.
38	Article 269, Clause 2, King's Regulations, 1906.	Examination for the rank of commander. Regulations now in force.
39	11 March 1912, Circular Letter 10.	Organisation and training of war staff. Regulations now in force.
40	August 1912.	Numbers of naval instructors.
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COMMITTEE ON EDUCATION.

Enclosure No. 1 in Third Report of Education Committee, dated 13th September 1912.

REGULATIONS FOR ENTRY OF NAVAL CADETS.

Now in force.

1. All Naval Cadets enter the Service under identical conditions, and are trained together until they pass for the rank of Lieutenant.

2. After passing for the rank of Lieutenant, they may be required to serve either as general service Officers or in one of the special branches, undertaking either Engineering, Gunnery, Torpedo, Navigation, or Marine duty.

3. As far as possible Officers selected for special service will be allowed to choose the branch in which they will qualify, subject to the proviso that all branches are satisfactorily filled.

Parents or guardians of Candidates for appointment as Naval Cadets must undertake for them that they are prepared to serve in any branch if required.

4. Parents or guardians are required to declare in writing their intention that the Candidate, if he obtains a Cadetship, shall adopt the Navy as his profession in life, and it is subject to this undertaking that Candidates are selected for Cadetships. Every Cadet who enters the Royal Naval College must therefore be prepared to continue his training so long as the Admiralty are satisfied with his progress, and parents are not at liberty to withdraw their sons at will.

On the entry of a Cadet, parents or guardians will be required to undertake that, in the event of his withdrawing or being withdrawn from the College, or from the Navy before being confirmed as a Sub-Lieutenant, they will pay to the Admiralty, if demanded, the sum of 25*l.* per term in respect of each term passed by him at the R.N. Colleges, Osborne and Dartmouth, from the date of his entry to the date of his withdrawal, as a contribution towards the balance of the cost of his training and maintenance not covered by the annual payment of 75*l.* mentioned in paragraph 12.

This undertaking does not apply to Cadets withdrawn at the request of the Admiralty under paragraphs 15-18.

5. Candidates must be of pure European descent, and the sons either of natural-born or of naturalized British subjects. In doubtful cases the burden of clear proof will rest upon the parents or guardians of Candidates.

6. Every Candidate (except Candidates who are being educated in the Colonies, and have received special Colonial recommendations under paragraph 7) will be required to present himself before a Committee, which will interview each applicant separately.*

Appointments to Naval Cadetships are made by the First Lord from among Candidates recommended by the Committee, and all such appointments are subject to the Candidate passing a Qualifying Literary Examination in educational subjects (*vide* par. 11), and a Medical Examination (*vide* par. 10).

The fact, however, of a Candidate being invited to appear before this Committee is not to be understood as in any degree implying that he will necessarily be chosen to attend the Qualifying Examination.

The Interviewing Committee will sit shortly before the date fixed for each Qualifying Literary Examination.

7. Members of the Board of Admiralty (other than the First Lord) have the privilege of specially recommending one Candidate each time, and the same privilege is granted to the Deputy Adjutant-General, Royal Marines.

A Flag Officer or Commodore 1st Class appointed to the Chief Command of a Naval Station, or to a separate command, and a Captain, R.N., on receiving his first

* Applications should be addressed to the Assistant Private Secretary to the First Lord, and should not be made until the Candidate has reached 12 years of age. The applications must be received at the Admiralty :

For the March examination before 1st January.			
Do.	July	do.	do. 1st May.
Do.	Dec.	do.	do. 1st October.

appointment to the command of a sea-going ship other than a tender or a ship with reduced nucleus crew, is allowed to recommend specially one Candidate, provided the privilege is exercised within six months of appointment and that the Candidate recommended is not less than twelve years of age at the time.

The Governments of certain Colonies are allowed to recommend specially (through the Secretary of State for the Colonies) a certain number of Candidates annually from among boys belonging to families resident in the Colonies.

All the specially recommended Candidates (with the exception of Colonial Candidates actually residing out of the United Kingdom) must be also recommended by the Interviewing Committee, and all such Candidates, without exception, must pass the Qualifying Educational Examination.

8. The Qualifying Examinations are held in March, July, and December, and the appointments date from the 15th May, 15th September, 15th January following, respectively.

*9. Candidates are eligible only for one interview and Qualifying Examination.

Candidates for examination in—

March	must not be less than 12 years and 8 months nor more than 13 years of age on the following	- 15 May,
July	Do.	- 15 Sept.,
Dec.	Do.	- 15 Jan.

10. Every Candidate must be in good health, and free from any physical defect of body, impediment of speech, defect of sight or hearing, and also from any predisposition to constitutional or hereditary disease or weakness of any kind, and be in all respects well developed and active in proportion to his age. Before undergoing the Qualifying Examination he is required to pass the medical examination according to the prescribed regulations, and must be found physically fit for the Navy.

It should be particularly noted that full normal vision—as determined by Snellen's tests—is required. A Memorandum is issued by the Admiralty which gives details of the physical requirements of Candidates.

†11. The Qualifying Examination is in the following subjects:—

- (1) English (including writing from dictation and reproduction of the gist of a short passage twice read aloud to the Candidates).
- (2) History and Geography, with special reference to the British Empire.
- (3) Arithmetic and Algebra (two-thirds of the questions in this paper will be on Arithmetic. The use of Algebraic symbols and processes will be allowed).

Arithmetic. The simple and compound rules, avoirdupois weight, linear and square and cubic measures, the elementary mensuration of rectangular surfaces and volumes, measure of capacity (pints, quarts, gallons), the metric system (the metre, gramme and litre, with their multiples and sub-multiples), money (including the relationship of the cent to the dollar, and the centime to the franc), reduction, simple proportion, factors, the addition, subtraction, multiplication, division and simplification of vulgar fractions, and non-recurring decimal fractions.

Algebra. The meaning of algebraical symbols, substitution of values, easy identities, equations of the first degree, including simultaneous equations, verification of the solution of equations, problems leading to simple equations.

- (4) Geometry. The paper will consist of questions both on Practical and on Theoretical Geometry.

All Candidates must be provided with a ruler graduated in inches and tenths and also in centimetres and millimetres, a small set square, a protractor, pencil compasses, and a hard pencil.

* Should any case occur where a selected Candidate is prevented by illness from attending the Qualifying Examination, the Admiralty will consider whether special arrangements can be made for him to be examined by the Head Master of the Royal Naval College, Osborne, at the beginning of the ensuing term.

† Note.—Copies of the papers set at the examinations held in each year are printed by the Oxford and Cambridge Schools Examination Board, and may be obtained on application to the Secretary of the Admiralty, free of charge.

• Proofs of the validity of constructions will not as a rule be expected, but they may be asked for. No proofs of theorems will be set.

Practical Geometry. Bisection of angles and straight lines, construction of perpendiculars to straight lines, construction of triangles with three parts given, formation of such angles as 60° , 30° , 45° , $22\frac{1}{2}$, without the use of the protractor, construction of angles equal to a given angle, construction of squares, rectangles and parallelograms, construction of parallels to a given straight line, division of straight lines into a number of equal parts.

Theoretical Geometry. Definitions of the principal terms used either in Practical or in Theoretical Geometry within the limits of the syllabus. The substance of the theorems contained in Euclid, Book I., Propositions 4-6, 8, 13-15, 26-30, 32-34, without formal proofs. Very simple deductions from these theorems. The order in which the theorems are stated is not imposed as the sequence of their treatment.

- (5) French or German, with an oral examination to which importance will be attached.
- (6) Latin (easy passages for translation from Latin into English and from English into Latin, and simple grammatical questions).

The list of successful Candidates will be published in alphabetical order.

12. For all Cadets entered under these regulations the payment will be at the rate of $75l.$ per annum for the period under training at the Colleges, to be paid in sums of $25l.$ every term in advance to the Cashier of the Bank of England on receipt of claim from the Accountant-General of the Navy. But the Lords Commissioners of the Admiralty reserve the power of selecting from among the Cadets entered at each Examination a limited number, being sons of Officers of the Navy, Army, or Marines, or of Civil Officers under the Board of Admiralty, with respect to whom the annual payment will be $40l.$ only. In this selection their Lordships will have regard solely to the pecuniary circumstances of the Cadet.

Applications for the Reduced Seale must be received at the Admiralty not later than 1st January, 1st May, and 1st September.

Parents or guardians are further required to make a private allowance of $50l.$ per annum to Cadets from the time they leave the Royal Naval College at Dartmouth until they reach the rank of Acting Sub-Lieutenant.

13. In addition to the annual payments mentioned in the foregoing paragraph, the parent or guardian is charged with the cost of outfit and the personal expenses incurred by the Cadet for washing, repairing boots and clothes, pocket-money instruments, school books, sports, &c.

14. The period of training is four years and eight months (*i.e.*, two years at the Royal Naval College, Osborne, two years at the Royal Naval College, Dartmouth, and two terms in the Training Cruiser). The three terms of each year are approximately as follows: 15th January to 15th April, 7th May to 7th August, 15th September to 15th December.

The vacations at the Royal Naval Colleges are four weeks at Christmas, three weeks at Easter, and six weeks at Midsummer.

15. It is to be distinctly understood that the period of training, including the time spent in the Training Cruiser, is a time of probation, and the parent or guardian of every Cadet is required to sign a declaration, on the admission of the Cadet, to the effect that he shall be immediately withdrawn on the receipt of an official request for his withdrawal. The Lords Commissioners of the Admiralty reserve to themselves full discretion to request the withdrawal of any Cadet from training, if after a sufficient trial he is in their opinion, for any reason, unsuitable for the Naval Service. This discretion will, as a rule, be exercised at the end of the first year, but the proficiency and progress of the Cadets will be periodically determined, and they may be required, if necessary, to withdraw at a later stage.

16. In all subjects of instruction the principle will be followed of giving merit marks for current work. At the end of each term the Cadet's proficiency and progress will be determined, partly by examination and partly by the marks gained for current work.

17. Cadets who fail to reach a certain standard, or who, for any reason, are considered unsuitable for the Naval Service, may be required to withdraw at any time.

This rule will apply to those who do not show an aptitude for Naval life, as well as to those who make insufficient progress, or whose constitution is weak, although no disease may have developed.

18. Cadets whose conduct is unsatisfactory may at any time be required to withdraw.

19. The parent or guardian of every Cadet is required to provide outfit under the regulations in force.

20. No pay is allowed by Government to Cadets in the training establishments, except in the case of Cadet Captains, who receive a small weekly allowance. The pocket-money allowed to Cadets is charged to the parents.

By Command of their Lordships,

W. GRAHAM GREENE.

Admiralty,

June 1909.

Enclosure No. 2 in Third Report of Education Committee, dated 13th September 1912.

PHYSICAL REQUIREMENTS FOR CANDIDATES FOR COMMISSIONS IN THE ROYAL NAVY.

Now in force.

With a view to preventing Candidates who may be physically unfit for His Majesty's Service from incurring the inconvenience and expense of preparing for commissions in the Royal Navy, it is suggested that they undergo examination by the medical adviser of the family, or any other qualified medical practitioner, to whom the following list of defects which cause rejection may be submitted for guidance.

It is to be understood that this private examination is merely suggested as a guide for intending Candidates and to lessen the chances of disappointment, and that it is by no means intended to take the place of, or to influence in any way, the regular Official Physical Examination.

1. A weak constitution, imperfect development, physical weakness, either hereditary or from chronic disease, wounds, or injuries.

2. Skin disease, unless temporary or trivial.

3. Malformation of the head, deformity from fracture or depression of the bones of the skull, impaired intellect, epilepsy, paralysis, or impediment of speech.

4. Blindness or defective vision, imperfect perception of colours, fistula, lachrymalis, or any chronic disease of the eyes or eyelids. Candidates for Naval Cadetships must possess full normal vision as determined by Snellen's tests, each eye being separately examined. For Candidates for other branches of the Royal Navy full normal vision is not required, but any defect of vision must be due to errors of refraction which can be corrected to normal by glasses, and vision without glasses must in any case be not less than $\frac{6}{5}$ with each eye, and the Candidate must also be able to read D = o, 6 of Snellen's test types.

5. Impaired hearing, or discharge from one or both ears, or any disease of the external, middle, or internal ear.

6. Disease of the bones of the nose, or of its cartilages, nasal polypus, or disease of the naso-pharynx.

7. Disease of the throat, tongue, palate, or tonsils; many unsound teeth,* unhealthy gums, disease of the glands of the throat or neck, external cicatrices, if at all extensive, and especially if adherent.

* i.e.—*Seven teeth defective or deficient in persons under 17 years of age on the date of entry, 10 defective or deficient teeth in persons above the age of 17—a tooth being considered as defective when it cannot be made permanently serviceable by dental repair. Credit is also given for teeth which have not erupted. Candidates must, however, possess some sound opposing molars and incisors. The numbers given above are intended as a general guide, and are not necessarily strictly adhered to, provided the general condition of the teeth is good.*

8. Functional or organic disease of the heart or blood vessels, deformity or contraction of the chest, or any symptom of lung disease or tendency thereto.

9. Undue swelling or distension of the abdomen, obesity, disease or enlargement of the abdominal organs. Rupture, weakness or distension of the abdominal rings; any disease of the bladder or incontinence of urine.

10. The existence of any defect of the genital organs, or of varicocele, when it clearly forms or is likely to form a serious impediment to the efficient performance of duty, e.g., when it is associated with varicose veins or piles.

11. Paralysis, weakness, impaired motion, or deformity of the upper or lower extremities, from whatever cause; a varicose state of the veins, especially of the leg. Bunions, distortion or malformation of the hands, feet, fingers, or toes.

12. Distortion of the spine, of the bones of the chest, or pelvis, from injury or constitutional defect.

No person will be admitted into His Majesty's Service unless he has been vaccinated. Re-vaccination will also be required if considered necessary.

Admiralty,
July 1911.

ADMIRALTY,
12th September 1908.

Enclosure No. 3 in Third Report of Education Committee, dated 13th September 1912.

NAVAL CADETS.

REGULATIONS respecting CADETS while at the ROYAL NAVAL COLLEGES at OSBORNE and DARTMOUTH, and on board the TRAINING CRUISERS.

Now in force.

(For the information of Parents and Guardians.)

1. Naval Cadets will undergo a course of instruction in the Shore Training Establishments for a period of four years, of which two years will be at Osborne, and the remainder at Dartmouth; there will be three terms in each year. On passing out of the College at Dartmouth they will continue their training for six months on board a special Training Cruiser.

Arrangements are made for the conveyance from Portsmouth to Osborne of the Cadets who are joining the College for the first time. Such Cadets should assemble at the Dockyard Gates (near Portsmouth Harbour Station) shortly before 3 p.m. on the day appointed for joining. Cadets rejoining the College will be expected to make their own arrangements for doing so.

2. The Terms are from about the following dates:—

15th January to 15th April,

7th May to 7th August,

15th September to 15th December;

and the Vacations at the Colleges are four weeks at Christmas,

three weeks at Easter, and

six weeks at Midsummer.

3. The friends of the Cadets must be prepared to receive them during all the Vacations.

4. The following payment is required from the Parents or Guardians of each Cadet while in Training Establishments as a contribution towards the cost of his education:—

At the commencement of each term 25*l.*, except in the case of those received at the reduced rate of 40*l.* a year, whose payments will be 13*l.* 6*s.* 8*d.* only. Claims will be made upon the Parents or Guardians by the Accountant-General of the Navy for these sums as they become due, and the money should be at once remitted.

This payment will cease on the Cadet joining the Training Cruiser. Parents or Guardians will then be required to make the Cadet a private allowance of 50*l.* a year until he reaches the rank of Sub-Lieutenant.

5. In addition to the above payments, any expenses incurred by a Cadet for clothing, sports, books, instruments, washing, &c., as well as the allowance of 1*s.* a week

paid as pocket-money, are included in the personal account sent to the Parent from the College as soon as possible after the end of each term.

6. All travelling expenses for Cadets are advanced by the Paymaster of the College, who will charge the sum to the Cadet's personal account.

7. Inasmuch as the Cadets have a weekly allowance paid to them as pocket-money, and a charge is made to pay the expenses attending their amusements, it is unnecessary that their friends should give them any money except on joining or on their return from the Vacations, and the amount should then be reasonable. Such money as may be required by a Cadet for any special circumstances will be advanced by the Paymaster under the authority of the Captain.

8. Any valuable Gold Watches or Chains brought by Cadets will be taken from them and placed in security until the Cadets return home. Silver Watches may be used.

9. Cadets are to bring their Linen clean, and Clothes and Boots in good order, when they join the College, and also when they return from leave, and the outfit, as specified on pages 54 and 55, must be complete. A list of the clothes left behind will be sent with Cadets when they go on leave.

10. Cadets are not permitted to open accounts with Tradesmen. Parents or Guardians are requested not to allow their sons' outfitters to supply clothes or other articles without their authorisation.

11. Each Cadet on joining and on returning after the Vacations is required to produce a health certificate—signed by his Parent or Guardian *not earlier than the day before the Cadet's return*—to the effect that, so far as is known, he has not for at least three weeks immediately preceding his return been exposed to any infectious disease, or entered any house where such disease has existed. A certificate, drawn up in the necessary Form, is sent to each Parent, and failure on the part of the Cadet to produce this certificate, duly filled up and signed, on his return will entail his not being received.

In the event of a Cadet being placed on the Sick List, information is always sent to his Parents or Guardians, who are also kept informed of the progress of the patient should the illness be in the slightest degree serious.

12. Letters relative to the Cadets should be addressed to "*The Commanding Officer, Royal Naval College*," or "*The Commanding Officer, H.M.S.*," and not to the Captain by name.

Parents or Guardians of Cadets must, in all cases of permanent change of residence, communicate the same to the Admiralty and to the Commanding Officer of the College or the Cruiser without delay.

13. The course of study includes the following subjects:—

Mathematics, with Geometrical Drawing.

Physics and Chemistry.

Mechanics and Applied Mechanics, with laboratory work.

Applied Electricity, with Laboratory work.

Engineering, with workshop practice and Mechanical Drawing.

Seamanship, with Gunnery in the Training Cruiser.

Navigation.

French, with German later.

English Grammar and Composition.

English Literature.

History, including Naval History.

Geography.

Bible Study.

Drill and Physical Training.

A large proportion of the time of the Cadets is given to the practical study of Engineering in the Workshops and Instructional Steamboats attached to the Colleges, and also in the Training Cruisers.

14. In addition to the lessons which the Cadets receive in the Instructional Steamboats, they are, while in their first term at Osborne, sent out for a period of about a week in a Cruiser in order that they may acquire an early familiarity with the actual working conditions of sea life.

15. In all subjects of instruction the principle will be followed of giving merit marks for current work. At the end of each term the Cadet's proficiency and progress

will be tested, partly by examination, and partly by the marks gained for current work.

16. (a) The passing-out examination of Cadets consists of two parts: Part I. is taken at the conclusion of the College course and Part II. after the Cruiser training.

(b) Part I. is representative of all the subjects studied at the College, with the exception of Bible study, which does not form part of the official examination, and of Seamanship, which is deferred to Part II. Marks for work done during previous terms are combined with the marks directly awarded in the examination.

(c) In Part II. the subjects are arranged in two groups as follows:—

- A. Navigation and Science;
- B. Seamanship, Gunnery and Engineering;

an equal aggregate of marks being assigned in each group.

(d) First, Second and Third Classes will be awarded in Part I. and in each group of Part II.

(e) The Class obtained in passing out counts afterwards towards promotion to the rank of Sub-Lieutenant, promotion being accelerated according to the following scale:—

For a First Class in Part I.	-	-	-	-	-	2 months.
For a Second Class in Part I.	-	-	-	-	-	1 month.
For a First Class in either group of Part II.	-	-	-	-	-	1 month.
For a Second Class in either group of Part II.	-	-	-	-	-	$\frac{1}{2}$ month.

The greatest amount of time that can be gained on passing out is accordingly four months.

(f) The order of merit on passing out is determined by the aggregate results of both parts.

17. Cadets who fail to attain a certain standard, or who, for any reason, are considered unsuitable for the Naval Service, may be required to withdraw at any time.

This rule will apply to those who do not show an aptitude for Naval life, as well as to those who make insufficient progress, or whose constitution is weak, although no disease may have developed.

18. Cadets whose conduct is unsatisfactory may at any time be required to withdraw.

19. It is to be distinctly understood that the period of training, including the time spent in the Training Cruiser, is a time of probation, and the Parent or Guardian of every Cadet is required to sign a declaration on the admission of the Cadet, to the effect that he shall be immediately withdrawn on the receipt of an official request for his withdrawal. The Lords Commissioners of the Admiralty reserve to themselves full discretion to request the withdrawal of any Cadet if, after a sufficient trial, he is in their opinion for any reason unsuitable for the Naval Service. This discretion will, as a rule, be exercised at the end of the first year; but the proficiency and progress of the Cadets will be periodically determined, and they may be required, if necessary, to withdraw at a later stage.

20. When a Cadet is found to be making insufficient progress a letter is sent to his Parent or Guardian warning him of the possibility of having to withdraw the Cadet unless a marked improvement takes place. This warning is generally issued a term in advance, to enable the Parent provisionally to make other arrangements for continuing the boy's education in case his withdrawal should become necessary.

21. Parents or Guardians are required to declare in writing their intention that the Candidate, if he obtains a Cadetship, shall adopt the Navy as his profession in life; and it is subject to this undertaking that Candidates are selected for Cadetships. Every Cadet who enters the Royal Naval College must be prepared to continue his training so long as the Admiralty are satisfied with his progress, and Parents are not at liberty to withdraw their sons at will. In the event of the withdrawal of a Cadet from the College, or from the Royal Navy, before being confirmed as a Sub-Lieutenant the Parent or Guardian of the Cadet will be required to pay to the Admiralty, if demanded, the sum of 25*l.* per term in respect of each term spent at the R.N. Colleges, Osborne and Dartmouth, from the date of his entry to the date of his withdrawal. This does not apply in the case of Cadets withdrawn under paragraphs 17-20.

By Command of their Lordships,

C. I. THOMAS.

LIST OF ARTICLES required for a NAVAL CADET under TRAINING.

---		Osborne.	Dartmouth.	Training Cruiser.	Remarks.
Sheets	-	6	6	6	
Pillow cases	-	3	3	3	
Uniform jacket*	-	1	1	1	
" trousers*	-	1	1	1	
" waistcoat*	-	1	1	1	
Flannel-lined waistcoat*	-	1	1	—	
Uniform caps, peak $\frac{1}{2}$ turned down*	-	2	2	2	
Working summer suit, blue tweed, with two prs. trousers.*	-	1	1	1	
Working winter suit, of special material*	-	1	1	1	The material of pattern jacket is to be strictly adhered to.
Loose-fitting overcoat—monkey jacket*	-	1	1	—	Used as overcoat at Osborne, and forms part of working winter suit at Dartmouth.
Cloth uniform monkey jacket	-	—	—	1	
Uniform greatcoat*	-	—	1	1	Optional at Osborne, as the loose-fitting monkey jacket is considered sufficient for ordinary wear.
White flannel trousers (well shrunk)	-	4	4	6	
" shirts (with collars to turn down).	-	6	6	6	
White day shirts	-	6	6	8	
Collars*	-	12	12	12	
Pyjama suits	-	3	3	4	
Socks	{ Merino	8	—	—	
{ Thick woollen	-	6	8	8	
Drawers	{ Thin merino (short)	4	—	—	
{ Thick for winter (long)	-	4	6	6	
Vests	{ Thin merino	4	—	—	
{ Thick for winter	-	4	6	6	
Bath towel	-	4	4	4	
Face towel	-	4	4	4	
Sweaters (high neck)	-	2	2	3	
Neckties (black silk of uniform pattern)	-	2	2	2	
Pocket handkerchiefs	-	12	12	12	
White woollen gloves	-	2	2	2	
Braces	-	2	2	2	
Boots, strong laced, soles at least $\frac{3}{8}$ thick	-	3	2	2	
Shoes, Oxford patent leather, with strong soles.	-	1	1	1	Plain fronts, no toecaps.†
Uniform gaiters	-	1	1	1	
Hair-brush, comb, clothes-brush, toothbrush, nail-brush, sponge.	-	1	1	1	
Soiled linen bag, with name	-	2	2	2	
Rug, of uniform pattern*	-	1	1	1	
Portmanteau, with name	-	1	1	1	To be of following dimen- sions 2 ft. 4 in. \times 1 ft. 5 in. \times 1 ft. 1 in.
Travelling bag, with initials	-	1	1	1	To be of such a size that it can be stowed inside Port- manteau when latter is empty.
Key ring	-	1	1	1	
Overall suits	-	2	2	1	Material supplied by Admiralty.
Waterproof coat	-	1	1	1	
Football knickers, jersey, boots, and stockings.	-	1	1	1	Obtainable at College.
Gymnastic belt	-	1	1	1	
Linen cricket bat	-	1	1	1	
Straw hat	-	1	1	1	
Knife lanyards	-	as necessary	—	—	
White canvas gymnastic shoes	-	1	1	1	Obtainable at College.
Brown canvas shoes, with thick rubber soles.	-	1	1	1	

* A pattern can be seen at the Admiralty.

† For first year at the Royal Naval College, Osborne, Cadets may wear any suitable black laced boots which they have been wearing prior to joining the College.

	Osborne.	Dartmouth.	Training Cruiser.	Remarks.
Chest covers	-	-	-	2
Cap covers	-	-	-	3
Duck trousers	-	-	-	3
Comforter	-	-	-	1
Shoes, thick, for engine room	-	-	-	1
Gloves for engine room	-	-	-	1
Midshipman's sea chest complete	-	-	1	Length, 3 ft. 6 ins.; breadth, 2 ft.; height, 2 ft. 3 ins. - name in full on plain brass plate to be attached.

It is particularly requested that the sea chest may be at Osborne seven days previous to the Cadet's joining.

Note.—1. Clothing to be distinctly marked with the Cadet's name in full.

2. Trousers to be made without pockets, and the two working suits to have only one pocket on left outside breast, and one pocket inside right breast.
3. There is no special pattern for underclothing.
4. Government bedding will be supplied, for which a charge of 1s. per month will be made. (This does not include sheets or pillow cases.)

The following articles can be supplied at the Colleges if the Cadets require them :—

Braces.	Collar studs.	Cashmere scarves.
Silk ties (uniform).	Front studs.	Bathing drawers.
Tooth-brushes.	Links.	Cricket shoes.
Tooth powder and paste.	Bootlaces.	Key rings.

Articles supplied at the Colleges will be charged to the Cadet's personal account; they will be charged at cost price, allowing sufficient margin to cover expense of transit only.

REGULATIONS respecting SEXTANTS.

Cadets when entering on their fifth term at Dartmouth should already have procured a Sextant in a box, such instrument being obtained by Parents; a leather case is not necessary.

Any new Sextant must be approved by the Captain of the College and must have the following qualifications :—

1. Strong frame and well finished in all respects: all loose fittings to be stamped with the number.
2. Radius not to be less than $6\frac{1}{2}$ inches to middle of the graduation.
3. Are distinctly cut, and to read to 10 seconds up to at least 125° on, and 5° off, the arc, the vernier being divided three divisions to the right of the index.
4. Shades to be of neutral tint and of satisfactory densities.
5. A star telescope (not inverting images) to be provided, and an inverting telescope with two eyepieces, one of which to have a magnifying power of at least 7 diameters. The telescopes and collar to be fitted with interrupted thread.
6. Adjusting screws to mirrors to be placed in positions as little exposed as possible, preferably at the base of the mirrors, to be recessed so as to be moved by a squared key or screw-driver and fitted with covers.
7. Two shades for eyepieces of different intensities to be ground conical, to slip on, not screw.
8. Handle to be of good size.
9. Each Sextant must be accompanied by a Kew Certificate, Class A.
10. A button over the handle besides the usual choeks for keeping the instrument in place when the lid is closed. Box to have recessed hooks for securing the lid, and a recessed handle.
11. No Sextants will be accepted in which the unsilvered portion of the horizon glass is absent, or the telescope so fitted as not to be entirely removable in one piece, and the horizon glass should have a minimum width of $1-1/8$ ineh.

12. The name of the owner to be on both Sextant and box.

Sextants possessing the necessary qualifications can be obtained from various makers.

A good 6½-inch instrument can be obtained for 7*l.* 10*s.*

Sextants presented to Cadets which have belonged to parents or others are not required to conform rigidly to the standard, provided they are of radius not less than that prescribed and are considered suitable by the Captain of the College; but no Sextant can be accepted unless accompanied by a Kew Certificate, Class A.

Enclosure No. 4 in Third Report of Education Committee, dated 13th September 1912.

NAVAL CADETS.

REGULATIONS FOR ENTRY AND TRAINING,

as proposed by the Committee.

1. No nomination is required by a Candidate for a Naval Cadetship. An application addressed to the Assistant Private Secretary to the First Lord of the Admiralty is all that is necessary.

2. Candidates must be of pure European descent, and the sons either of natural-born or naturalized British subjects. In doubtful cases the burden of clear proof will rest upon the parents or guardians of Candidates.

3. Candidates for examination in March must not be less than 12 years

and 8 months nor more than
13 years of age on the
following - - - - 15th May,

Do.	do.	July	do.	do.	15th Sept.,
Do.	do.	Dec.	do.	do.	15th Jan.

4. Every Candidate (except Candidates who are being educated in the Colonies, and have received special Colonial recommendations under paragraph 8) will be required to present himself before a Committee, which will interview each applicant separately. Applications should not be made until the Candidate has reached 12 years of age.

The applications must be received at the Admiralty:—

For the March examination before 1st January,

“ “ July “ “ 1st May,

“ “ Dec. “ “ 1st October.

Appointments to Naval Cadetships are made by the First Lord from among Candidates recommended by the Committee, and all such appointments are subject to the Candidate passing a Medical Examination (*see* paragraph 5) and a Qualifying Literary Examination in educational subjects (*see* paragraph 6).

The fact, however, of a Candidate being invited to appear before this Committee is not to be understood as in any degree implying that he will necessarily be chosen to attend the Qualifying Examination.

The Interviewing Committee will sit shortly before the date fixed for each Qualifying Literary Examination.

*Candidates are eligible only for one Interview and Qualifying Examination.

5. Every Candidate must be in good health, and free from any physical defect of body, impediment of speech, defect of sight or hearing, and also from any predisposition to constitutional or hereditary disease or weakness of any kind, and be in all respects well developed and active in proportion to his age. Before undergoing the Qualifying Examination he is required to pass the Medical Examination according to the prescribed regulations, and must be found physically fit for the Navy.

It should be particularly noted that full normal vision—as determined by Snellen's tests—is required. A memorandum is issued by the Admiralty which gives details of the physical requirements of candidates.

A Medical Board of Appeal has been instituted to meet cases in which the Parent or Guardian of a Candidate is not satisfied with the result of the Official Medical Examination. This Appeal Board will consist of the Director General of the Medical Department of the Navy, a physician nominated by the Medical Consultative Board, and a specialist in the particular defect which caused the disqualification of the Candidate, to be selected from a list drawn up by the Consultative Board.

*Should any case occur where a selected candidate is prevented by illness from attending the qualifying examination, the Admiralty will consider whether special arrangements can be made for him to be examined by the Head Master of the Royal Naval College, Osborne, at the beginning of the ensuing term.

In the event of the rejection on medical grounds of a Candidate, who would otherwise have been selected for the Qualifying Literary Examination, the Parent or Guardian will at once be informed that, subject to the payment of a fee of four guineas, the Candidate may present himself for re-examination by the Appeal Board, and that if an appeal is desired notification must be made by the Parent or Guardian to the Director General of the Medical Department, Admiralty, within a week of the first Medical Examination. The notification must be accompanied by a cheque for four guineas made payable to the Accountant General of the Navy.

*6. The Qualifying Examination is in the following subjects: -

- (1) English (including writing from dictation and reproduction of the gist of a short passage twice read aloud to the Candidates).
- (2) History and Geography, with special reference to the British Empire.
- (3) Arithmetic and Algebra (two-thirds of the questions in this paper will be on Arithmetic. The use of Algebraic symbols and processes will be allowed).

Arithmetic. The simple and compound rules, avoirdupois weight, linear and square and cubic measures, the elementary mensuration of rectangular surfaces and volumes, measure of capacity (pints, quarts, gallons), the metric system (the metre, gramme and litre, with their multiples and sub-multiples), money (including the relationship of the cent to the dollar, and the centime to the franc), reduction, simple proportion, factors, the addition, subtraction, multiplication, division and simplification of vulgar fractions, and non-recurring decimal fractions.

Algebra. The meaning of algebraic symbols, substitution of values, easy identities, equations of the first degree including simultaneous equations, verification of the solution of equations, problems leading to simple equations.

(4) Geometry. The paper will consist of questions both on Practical and on Theoretical Geometry.

All Candidates must be provided with a ruler graduated in inches and tenths, and also in centimetres and millimetres, a small set square, a protractor, pencil compasses, and a hard pencil.

Proofs of the validity of constructions will not as a rule be expected, but they may be asked for. No proofs of theorems will be set.

Practical Geometry. Bisection of angles and straight lines, construction of perpendiculars to straight lines, construction of triangles with three parts given, formation of such angles as 60° , 30° , 45° , $22\frac{1}{2}^\circ$, without the use of the protractor, construction of angles equal to a given angle, construction of squares, rectangles and parallelograms, construction of parallels to a given straight line, division of straight lines into a number of equal parts.

Theoretical Geometry. Definitions of the principal terms used either in Practical or in Theoretical Geometry within the limits of the syllabus. The substance of the theorems contained in Euclid, Book I., Propositions 1-6, 8, 13-15, 26-30, 32-34, without formal proofs. Very simple deductions from these theorems. The order in which the theorems are stated is not imposed as the sequence of their treatment.

(5) French or German, with an oral examination to which importance will be attached.

(6) Latin (easy passages for translation from Latin into English and from English into Latin, and simple grammatical questions).

The list of successful Candidates will be published in alphabetical order.

7. The Qualifying Examinations are held in March, July, and December, and the appointments of selected Candidates date from the 15th May, 15th September, 15th January following, respectively.

8. Members of the Board of the Admiralty (other than the First Lord) have the privilege of specially recommending one Candidate each time, and the same privilege is granted to the Deputy Adjutant General, Royal Marines.

*NOTE—Copies of the papers set at the examinations held in each year are printed by the Oxford and Cambridge Schools Examination Board, and may be obtained on application to the Secretary of the Admiralty, free of charge.

A Flag Officer or Commodore First Class appointed to the Chief Command of a Naval Station, or to a separate command, and a Captain, R.N., on receiving his first appointment to the command of a sea-going ship other than a tender or a ship with reduced nucleus crew, is allowed to recommend specially one Candidate, provided that the privilege is exercised within six months of appointment and that the Candidate recommended is not less than 12 years of age at the time.

The Governments of certain Colonies are allowed to recommend specially (through the Secretary of State for the Colonies) a certain number of Candidates annually from among boys belonging to families resident in the Colonies.

All the specially recommended Candidates (with the exception of Colonial Candidates actually residing out of the United Kingdom) must be also recommended by the Interviewing Committee, and all such Candidates, without exception, must pass the Qualifying Literary Examination, and the Medical Examination.

9. Naval Cadets will undergo a course of instruction in the Shore Training Establishments for a period of four years, of which two years will be at Osborne and the remainder at Dartmouth. On passing out of the College at Dartmouth they will continue their training for a period on board a special Training Cruiser, and will then be sent to the sea-going fleet as Midshipmen.

10. The following are the approximate dates for the beginning and end of the three terms at the Colleges:—

16th January to 15th April,
8th May to 6th August,
19th September to 17th December.

The vacations at the Colleges are as follows:—

Four weeks at Christmas,
Three weeks at Easter,
Six weeks at Midsummer.

11. The friends of the Cadets must be prepared to receive them during all the Vacations.

12. All Naval Cadets shall be subject to the Regulations for the time being in force respecting Cadets while at the Royal Naval Colleges at Osborne and Dartmouth and on board the Training Cruisers.

13. For all Cadets entering under these Regulations, payment will be at the rate of 75*l.* per annum for the period under training at the Colleges, to be paid in sums of 25*l.* every term in advance to the Cashier of the Bank of England on receipt of claim from the Accountant-General of the Navy. But the Lords Commissioners of the Admiralty reserve the power of selecting at each Examination a certain number not exceeding 20 per cent., with respect to whom the annual payment will be 24*l.* only, payable in sums of 8*l.* every term in advance. A proportion of those admitted at the reduced scale will be sons of Officers of the Navy, Army or Marines, or of Civil Officers under the Board of Admiralty.

In making the selection for this reduced scale Their Lordships will have regard to the pecuniary circumstances of the Candidate, but no Candidate will be admitted on the reduced scale unless he passes the Qualifying Examination with some credit.

This reduction of fee will ordinarily extend throughout the courses at the College subject to good conduct and satisfactory progress.

An application for the reduced scale, if made, should accompany that referred to in paragraph 1, and should be received at the Admiralty:—

For the March examination before 1st January,
" July " " 1st May,
" December " " 1st October.

Claims will be made upon the Parents or Guardians by the Accountant-General of the Navy for the sums payable as they become due, and the money should be at once remitted.

14. In addition to the above payments, any expenses incurred by a Cadet for clothing, sports, books, instruments, washing, &c., as well as the allowance of 1*s.* a week paid as pocket money, are included in the personal account sent to the parent from the College as soon as possible after the end of each term.

15. No pay is allowed by Government to the Cadets in the Colleges, except in the case of Cadet Captains, who receive a small weekly allowance.

The pay of Cadets in the Training Cruisers is 1*s.* a day, and that of Midshipmen is 1*s.* 9*d.* a day.

16. The fees specified in paragraph 13 will cease on the Cadet joining the Training Cruiser. Parents or Guardians will then be required to make the Cadet a private allowance of 50*l.* a year until he reaches the rank of Acting Sub-Lieutenant, and thereafter a private allowance of 20*l.* a year for as long as he remains an Acting Sub-Lieutenant with pay at the rate of 3*s.* 6*d.* a day.

17. The parent or guardian of every Cadet is required to provide outfit under the regulations in force.

18. All travelling expenses for Cadets are advanced by the Paymaster of the College, who will charge the sum to the Cadet's personal account.

19. Inasmuch as the Cadets have a weekly allowance paid to them as pocket money, and a charge is made to pay the expenses attending their amusements, it is unnecessary that their friends should give them any money, except on joining or on their return from the Vacations, and the amount should then be reasonable. Such money as may be required by a Cadet for any special circumstance will be advanced by the Paymaster under the authority of the Captain.

20. Any valuable Gold Watches or Chains brought by the Cadets to the Colleges will be taken from them and placed in security until the Cadets return home. Silver Watches may be used.

21. Arrangements are made for the conveyance from Portsmouth to Osborne of the Cadets who are joining the College for the first time. Such Cadets should assemble at the Dockyard Gates (near Portsmouth Harbour Station) shortly before 3 p.m. on the day appointed for joining. Cadets rejoining the College will be expected to make their own arrangements for doing so.

22. Cadets are to bring their Linen clean, and Clothes and Boots in good order, when they join the College, and also when they return from leave, and the outfit, as specified on pages 60 and 61, must be complete. A list of the clothes left behind will be sent with Cadets when they go on leave.

23. Cadets are not permitted to open accounts with Tradesmen. Parents or Guardians are requested not to allow their sons' outfitters to supply clothes or other articles without their authorisation.

24. Each Cadet on joining and on returning after the Vacations is required to produce a health certificate—signed by his Parent or Guardian *not earlier than the day before the Cadet's return*—to the effect that so far as is known, he has not for at least three weeks immediately preceding his return been exposed to any infectious disease, or entered any house where such disease had existed. A certificate, drawn up in the necessary form, is sent to each parent, and failure on the part of the cadet to produce this certificate, duly filled up and signed, on his return will entail his *not being received*.

In the event of a Cadet being placed on the Sick List information is always sent to his Parents or Guardians, who are also kept informed of the progress of the patient should the illness be in the slightest degree serious.

25. Letters relative to the Cadets should be addressed to "The Commanding Officer, Royal Naval College" or "The Commanding Officer, H.M.S." and not to the Captain by name.

Parents or Guardians of Cadets must, in all cases of permanent change of residence, communicate the same to the Admiralty and to the Commanding Officer of the College or the Cruiser without delay.

26. The course of study includes the following subjects:—

Mathematics, with Geometrical Drawing.

Physics and Chemistry.

Mechanics and Applied Mechanics, with laboratory work.

Applied Electricity, with laboratory work.

Engineering, with workshop practice, and Mechanical Drawing.

Seaman ship, with Gunnery in the Training Cruiser.

Navigation.

French or German.

English Grammar and Composition.

English Literature.

History, including Naval History.

Geography.

Bible Study.

Drill and Physical Training.

A large proportion of the time of the Cadets is given to the practical study of Engineering in the Workshops and Instructional Steamboats attached to the Colleges and also in the Training Cruisers.

27. In all subjects of instruction the principle will be followed of giving merit marks for current work. At the end of each term the Cadet's proficiency and progress will be tested, partly by examination, and partly by the marks gained for current work.

28. The passing-out examination of Cadets is representative of all subjects studied at the College, with the exception of Bible Study, which does not form part of the official examination. Marks for work done during previous terms are combined with the marks directly awarded in the examination.

First, Second and Third Classes will be awarded, the class obtained in passing out counts afterwards towards promotion to the rank of Sub-Lieutenant, promotion being accelerated according to the following scale:—

For a First Class	-	-	-	-	2 months.
For a Second Class	-	-	-	-	1 month.

The greatest amount of time that can be gained on passing out is accordingly two months.

29. Cadets may be required to withdraw at any time, if in the opinion of the Lords Commissioners of the Admiralty:—

- (1) They fail to obtain a satisfactory standard, or
- (2) Their conduct is unsatisfactory, or
- (3) They are for any reason unsuitable for the Naval Service.

30. It is to be distinctly understood that the period of training, including the time spent in the Training Cruiser, is a time of probation, and the Parent or Guardian of every Cadet is required to sign a declaration on the admission of a Cadet to the effect that he shall be immediately withdrawn on the receipt of an official request for his withdrawal.

31. When a Cadet is found to be making insufficient progress a letter is sent to his Parent or Guardian warning him of the possibility of having to withdraw the Cadet unless a marked improvement takes place. This warning is generally issued a term in advance, to enable the Parent provisionally to make other arrangements for continuing the boy's education in case his withdrawal should become necessary.

32. Parents or guardians are required to declare in writing their intention that the Candidate, if he obtains a Cadetship, shall adopt the Navy as his profession in life; and it is subject to this undertaking that Candidates are selected for Cadetships. Every Cadet who enters the Royal Naval College must therefore be prepared to continue his training so long as the Admiralty are satisfied with his progress, and parents are not at liberty to withdraw their sons at will.

On the entry of a Cadet, Parents or Guardians will be required to undertake that, in the event of his withdrawing or being withdrawn from the College, or from the Navy before being confirmed as Sub-Lieutenant, they will pay to the Admiralty, if demanded, the sum of 25*l.* in respect of each term passed by him at the Royal Naval Colleges, Osborne and Dartmouth, from the date of his entry to the date of his withdrawal, as a contribution towards the balance of the cost of his training and maintenance not covered by the annual payments mentioned in paragraph 13.

This undertaking does not apply to Cadets withdrawn at the request of the Admiralty.

33. Those Officers who, after reaching Commissioned rank, specialize in Navigation, Gunnery, Torpedo or Engineering will be selected from Volunteers.

LIST OF ARTICLES required for a NAVAL CADET under TRAINING.

		Osborne.	Dartmouth.	Training Cruiser.	Remarks.
Sheets	-	-	-	6	6
Pillow cases	-	-	-	3	3
Uniform jacket*	-	-	-	1	1
“ trousers*	-	-	-	1	1
“ waistcoat*	-	-	-	1	1
Flannel-lined waistcoat*	-	-	Superfine	1	1
				1	1

* A pattern can be seen at the Admiralty.

	Osborne.	Dartmouth.	Frigate Cruiser.	Remarks.
Uniform caps, peak $\frac{1}{2}$ turned down*	2	2	2	
Working summer suit, blue tweed, with two prs. trousers.	1	1	1	
Working winter suit, of special material	1	1	1	The material of pattern jacket is to be strictly adhered to.
Loose-fitting overcoat, —monkey jacket ²	1	1	—	Used as overcoat at Osborne and forms part of working winter suit at Dartmouth.
Cloth uniform monkey jacket	—	—	—	1
Uniform greatcoat ²	—	—	1	1
White flannel trousers (well shrunk)	4	1	6	
“ shirts (with collars to turn down).	6	6	6	
White day shirts	6	6	8	
Collars*	12	12	12	
Pyjama suits	3	3	4	
Socks - } Merino - } 8 }	8	8	8	
“ Thick woollen - } 6 }	6	8	8	
Drawers - } Thin merino (short) - } 4 }	4	6	6	
“ Thick for winter (long) - } 1 }	1	6	6	
Vests - } Thin merino - } 4 }	4	6	6	
“ Thick for winter - } 1 }	1	6	6	
Bath towel	4	4	4	
Face towel	4	4	4	
Sweaters (high neck)	2	2	3	
Neckties (black silk of uniform pattern)	2	2	2	
Pocket handkerchiefs	12	12	12	
White woollen gloves	2	2	2	
Braces	2	2	2	
Boots, strong laced, soles at least $\frac{3}{8}$ thick	3	2	2	Plain fronts, no toecaps, †
Shoes, Oxford patent leather, with strong soles.	1	1	1	
Uniform gaiters	1	1	1	
Hair-brush, comb, clothes-brush, tooth-brush, nail-brush, sponge.	1	1	1	
Soiled linen bag, with name	2	2	2	
Rug, of uniform pattern*	1	1	1	
Portmanteau, with name	1	1	1	To be of following dimensions : 2 ft. 4 in. x 1 ft. 5 in. x 1 ft. 1 in.
Travelling bag, with initials	1	1	1	To be of such a size that it can be stowed inside Portmanteau when latter is empty.
Key ring	1	1	1	
Overall suits	2	2	1	Material supplied by Admiralty.
Waterproof coat	1	1	1	
Football knickers, jersey, boots, and stockings.	1	1	1	Obtainable at College.
Gymnastic belt	1	1	1	
Linen cricket hat	1	1	1	
Straw hat	1	—	1	
Knife lanyards	—	as necessary	—	Obtainable at College.
White canvas gymnastic shoes	1	1	—	
Brown canvas shoes, with thick rubber soles.	1	1	1	
Sea chest covers	—	—	2	
Cap covers	—	—	3	
Duck trousers	—	—	3	
Comforter	—	—	1	
Shoes, thick, for engine room	—	—	1	
Gloves for engine room	—	—	1	
Midshipman's sea chest complete	1	1	1	Length, 3 ft. 6 ins. ; breadth, 2 ft. ; height, 2 ft. 3 ins. —name in full on plain brass plate to be attached.

* A pattern can be seen at the Admiralty.

† For first year at the Royal Naval College, Osborne. Cadets may wear any suitable black laced boots which they have been wearing prior to joining the College.

It is particularly requested that the sea chest may be at Osborne seven days previous to the Cadets joining.

Note.—1. Clothing to be distinctly marked with the Cadet's name in full.

2. Trousers to be made without pockets, and the two working suits to have only one pocket on left outside breast, and one pocket inside right breast.
3. There is no special pattern for underclothing.
1. Government bedding will be supplied, for which a charge of 1s. a month will be made. (This does not include sheets or pillow cases.)

The following articles can be supplied at the Colleges if the Cadets require them:—

Braces.	Links.
Silk ties (uniform).	Bootlaces.
Tooth-brushes.	Cashmere scarves.
Tooth powder and paste.	Bathing drawers.
Collar studs.	Cricket shoes.
Front studs.	Key rings.

Articles supplied at the Colleges will be charged to the Cadet's personal account; they will be charged at cost price, allowing sufficient margin to cover expense of transit only.

REGULATIONS RESPECTING SEXTANTS.

Cadets when entering on their fifth term at Dartmouth should already have procured a Sextant in a box, such instrument being obtained by Parents; a leather case is not necessary.

Any new Sextant must be approved by the Captain of the College and must have the following qualifications:—

1. Strong frame and well finished in all respects: all loose fittings to be stamped with the number.
2. Radius not to be less than $6\frac{1}{2}$ inches to middle of the graduation.
3. Arc distinctly cut, and to read to 10 seconds up to at least 125° on, and 5° off, the arc, the vernier being divided three divisions to the right of the index.
4. Shades to be of neutral tint and of satisfactory densities.
5. A star telescope (not inverting images) to be provided, and an inverting telescope with two eyepieces, one of which to have a magnifying power of at least 7 diameters. The telescopes and collar to be fitted with interrupted thread.
6. Adjusting screws to mirrors to be placed in positions as little exposed as possible, preferably at the base of the mirrors, to be recessed so as to be moved by a squared key or screw-driver and fitted with covers.
7. Two shades for eyepieces of different intensities to be ground conical, to slip on, not screw.
8. Handle to be of good size.
9. Each Sextant must be accompanied by a Kew Certificate, Class A.
10. A button over the handle besides the usual chocks for keeping the instrument in place when the lid is closed. Box to have recessed hooks for securing the lid, and a recessed handle.
11. No Sextants will be accepted in which the unsilvered portion of the horizon glass is absent, or the telescope so fitted as not to be entirely removable in one piece, and the horizon glass should have a minimum width of 1-1/8 inch.
12. The name of the owner to be on both Sextant and box.

Sextants possessing the necessary qualifications can be obtained from various makers.

A good $6\frac{1}{2}$ -inch instrument can be obtained for 7*l.* 10*s.*

Sextants presented to Cadets which have belonged to Parents or others are not required to conform rigidly to the standard, provided they are of radius not less than that prescribed and are considered suitable by the Captain of the College; but no Sextant can be accepted unless accompanied by a Kew Certificate, Class A.

Enclosure No. 5 in Third Report of Education Committee, dated 13th September 1912

REGULATIONS FOR THE ENTRY INTO THE R.N. COLLEGE AT DARTMOUTH
OF CADETS FROM THE "CONWAY."

Now in force.

1. Six nominations to Cadetships in the Royal Naval College, Dartmouth, will be granted annually to the "Conway" training ship of the Mercantile Marine.

2. Shortly before the end of each Term, the Committee of the Conway may nominate two Cadets from their training ship, for admission to the College as Cadets of the Royal Navy, subject to their passing a qualifying examination and satisfying the conditions specified below.

Each Cadet so nominated will be required to pass an examination showing that he has reached the same general standard of training as is reached by Naval Cadets in leaving the Royal Naval College, Osborne.

3. The Examination will be conducted near the end of each Term, at the Royal Naval College, Osborne, and will include tests in practical knowledge of the use of tools and workshop processes as well as papers on the subjects dealt with in the Osborne curriculum.

The Candidates, if successful, will be admitted to the Royal Naval College, Dartmouth, from the beginning of the Term in January, May, or September following the examination.

4. Each Candidate must possess the following qualifications—

- (a) He must be of very good character and conduct, and in all respects fit for entry into H.M. Navy.
- (b) He must be not less than 14 years 8 months, nor more than 15 years old on the 15th January, 15th May, or 15th September following the examination.
- (c) He must have served in the training ship 2 years, *i.e.*, 6 terms, there being 3 terms a year.
- (d) He must have spent not less than one-fourth (or the equivalent of 6 months) of his 2 years' service in practical mechanical work under conditions satisfactory to the Admiralty.
- (e) Before attending the Qualifying Examination he must pass the Medical Examination for the Navy, according to the prescribed regulations.

5. The following certificates must be forwarded at the time the Candidates are nominated—

- (a) Certificate of birth.
- (b) " conduct.
- (c) " ability to swim.
- (d) " time served in training ship.
- (e) " time spent in practical mechanical work, with particulars of training.

The name and address of the Parent or Guardian must also be supplied.

6. The regulations as to the provision by Parents or Guardians of the outfit, the annual contribution of 75*l.* per annum while the Cadet is at Dartmouth, and the private allowance after passing out, will be the same as those with respect to other Naval Cadets.

7. Cadets entering under these regulations will be subject in all respects to the same discipline and conditions of service as other Cadets during their period of training at the R.N. College, Dartmouth, and will be liable to removal for the same causes.

On passing out, they will be treated in the same manner as the other Cadets, and will rank according to the time gained and their position on the list.

Note.—Application for entry in the "Conway" should be made to the Commanding Officer, School Ship "Conway," Rock Ferry, Cheshire.

By command of Their Lordships,

C. I. THOMAS.

Admiralty,
December, 1908.

Enclosure No. 7 in *Third Report of Education Committee*, dated 13th September 1912.

Royal Naval College, Osborne, I.W.,
9th July 1912.

AVERAGE COST PER ANNUM OF ONE CADET TO HIS PARENTS.

		£	s.	d.
Fees per annum as laid down (25 <i>l.</i> per term)	-	-	75	0 0
Personal expenses (average taken for all Cadets of last three terms)	-	16	5	0
Pocket money (36 weeks at 1 <i>s.</i> per week)	-	-	1	16 0
 Total (cost of travelling in addition)	-	-	93	1 0

DETAILS OF PERSONAL EXPENDITURE.

		£	s.	d.
Average washing bill per annum	-	-	3	10 0
Haircutting (1 <i>s.</i> 4 <i>d.</i> per term)	-	-	0	4 0
Use of bedding (4 <i>s.</i> per term)	-	-	0	12 0
Stationery supplied (average per annum)	-	-	0	12 0
Repair of clothing (average per annum), about	-	-	0	15 0
Bootmaker (actual expenses).				
Travelling (actual expenses).				
Instruments, School books, &c. (average per annum)	-	-	2	15 0
Cadets' Store, articles supplied from (average per annum)	-	3	5 0	
Postage, telegram, &c. per annum about	-	-	0	4 0
Pocket money (1 <i>s.</i> per week, 36 weeks)	-	-	1	16 0
Sports contributions (not to exceed 10 <i>s.</i> per term). Present rate 6 <i>s.</i>		0	18 0	

Optional Items:—

Dancing, 25*s.* per term, for two terms.

Fencing } each 6*d.* per lesson.

Boxing }

Music (either piano or violin), 36*s.* 6*d.* per term.

I believe this to be approximately correct and complete.

HORACE HOOD,
Captain, R.N.

Enclosure No. 8 in *Third Report of Education Committee*, dated 13th September 1912

C.E. 11845.

Admiralty,

2nd April 1912.

Sir,

With reference to Admiralty Letter C.W. 11589 of the 26th March, relative to the appointment of a Committee to inquire into the education and training of Cadets, Midshipmen, and Junior Officers of H.M. Fleet, I am &c. to state that they would be much obliged if the Board of Education could arrange for a selected body of Inspectors to carry out a full inspection of the Royal Naval Colleges at Osborne and Dartmouth with a view to placing before the Committee, for their confidential information, a report on the curriculum and system of instruction obtaining in these institutions, and, generally, on their educational efficiency. The suitability or otherwise of the College buildings, and the discipline of the Colleges, would lie outside the scope of the inspection.

My Lords would suggest that it would be convenient if the proposed inspection could be carried out about the end of May.

I am, Sir,

your obedient Servant,

The Secretary, Board of Education.

W. GRAHAM GREENE.

Enclosure No. 9 in Third Report of Education Committee, dated 13th September 1912.

BOARD OF EDUCATION.

WHITEHALL, LONDON, S.W.

REPORT OF AN INSPECTION

OF THE

ROYAL NAVAL COLLEGE,
OSBORNE,

HELD ON THE

21st, 22nd, 23rd and 24th May 1912,

AND OF AN INSPECTION

OF THE

ROYAL NAVAL COLLEGE,
DARTMOUTH,

HELD ON THE

27th, 28th, 29th and 30th May 1912.

Inspectors.

Mr. G. A. BAXANDALL, H.M.I.

Mr. S. F. DUFTON, H.M.I.

Mr. W. C. FLETCHER, H.M.I.

Mr. J. W. HEADLAM, H.M.I.

Mr. D. A. MACNAUGHTON, H.M.I.

Mr. J. A. McMICHAEL, H.M.I.

Mr. A. SCHWARTZ, H.M.I.

Mr. F. SPENCER, H.M.I.

Mr. F. B. STEAD, H.M.I.

Mr. G. WINTHROP YOUNG, H.M.I.

(NOTE.—It has been found possible to carry out the majority of the recommendations contained in the Report of these Inspections.)

OSBORNE: ROYAL NAVAL COLLEGE.

DARTMOUTH: ROYAL NAVAL COLLEGE.

Introduction.

The present system of educating and training Naval Officers commenced with the entry of a first batch of cadets to Osborne in September 1903.

Previous to this, future military and engineer officers had received quite different training and formed separate branches of the Service. Both alike entered by competitive examination, but while the former spent 12 or 15 months on the "Britannia" studying chiefly Navigation and Mathematics and went to sea at about 17, the latter learnt Engineering at Keyham for four years or more and did not go to sea till they were over 19.

Inasmuch as the use of machinery had become an essential part of every officer's work, and it was further held that the separation of the two branches had in itself undesirable results, it was decided that henceforward they should be amalgamated and receive a common education.

A first condition therefore of the work to be done at the Colleges was that it should prepare boys to be (up to a certain point) engineers as well as navigators.

It was further held that the age of going to sea must not be greatly raised ; school education therefore ceases at 17. To get through the necessary special work without total neglect of general education seemed to require four years ; the age of entry is consequently 13 (more exactly between 12·8 and 13·0 on the 15th of January, May, or September). At such an age competitive examination was held undesirable and was discarded.

Candidates for admission appear before a special Interview Committee, which classifies them according to its judgment of their relative fitness and reports to the First Lord, who selects a suitable number. Those selected take a qualifying examination (conducted by the Oxford and Cambridge Examination Board) and, if successful, enter the College at Osborne as cadets. After two years at Osborne they proceed to Dartmouth for another two years. Entry takes place three times a year, and each "term" of 60 to 80 cadets remains as a unit throughout the College course. After their four years, accordingly, all the cadets of each "term" pass out together ; under present arrangements they then go in a body to a cruiser for eight months (reduced to six by "leave") for further technical and professional instruction before actually going to sea in the fleet as midshipmen.

A boy may drop a term on account of illness or lack of success in his work. In very rare cases boys have been advanced a term.

It was provided to meet the obvious risks of the method of selection that boys who proved unsuitable or unequal to the work should be dropped altogether. It has not been found easy to carry this intention into effect, and the amount of "weeding" has not been large and has tended to decrease. For the first ten entries it exceeded 10 per cent., for the second ten it was barely 5. Further, the number of candidates for admission has not been as large as was hoped, and it has resulted that while a fair number of really able cadets has been obtained, the range in each term is very wide, the ability of a considerable number is not high, and in a small proportion of cases is distinctly low.

Each College is under the command of a captain with a full naval staff under him, viz., a commander, five or six lieutenants and a captain of marines ; engineer commander and lieutenants ; chaplain, surgeons, paymasters, warrant officers, artificers, &c.

Upon the naval staff rests the whole discipline of the College outside the "studies" (i.e., classrooms), each term being under the command of a lieutenant. Upon them falls also the instruction in seamanship and gymnastics and upon the engineers that in engineering.

Staff.

The professorial staff at each College is under the control of a Head Master, who has under him a number of "Heads of Departments" - Mathematics, Science, History and English, Modern Languages at both Colleges, Geography at Osborne, Navigation at Dartmouth. There are, besides, certain Senior Masters, ten at Osborne, eight at

Dartmouth, and a variable number of Assistant Masters, not exceeding 20 at Osborne, or 17 at Dartmouth. The actual numbers of Masters (including the Naval Instructors) in addition to the Head Masters are 34 at Osborne, 30 at Dartmouth. For the numbers of cadets (430 and 410) this is a slightly more generous allowance than is usual at schools, but as will appear below, the conditions of work at the Colleges are in many respects unusual, and nothing but a large staff would suffice.

As a whole, the staff at each College is extremely competent. In some subjects it has been difficult or impossible to secure men with high academic qualifications, but even in these cases the Head Masters have been fortunate and skilful in obtaining men whose real value is much beyond that indicated by their academic career. The Heads of Departments render most valuable service, the work in each subject being generally well arranged and co-ordinated throughout. It is rare to find a school in which the problem of the curriculum, always a difficult one, has been so carefully considered and reconsidered as in the Colleges, and great credit is due to the Head Masters and to their staffs for the thought they have expended on it, both in its larger outlines (for which, of course, they are not mainly responsible) and in its details. In actual teaching skill the general average is high; there are several brilliant teachers and few poor ones. Each man's teaching hours are reasonable and leave time both for real preparation (here even more necessary than in an ordinary school) and for adequate correction of written work. Men naturally vary in the use they make of these advantages, but the majority utilise them to the full.

In so far as teaching is given by Naval Officers, there is inevitably a certain loss, owing to the frequent changes characteristic of the Service; teaching skill is not acquired in a moment, and a man has hardly time to learn how best to do his work before he has to leave.

Some loss also necessarily results from the separation of the two Colleges. Provision is made for intercourse between the two staffs, but the two Colleges are so far apart that in practice there is not as much as is desirable. Instances of this will appear in the reports on Modern Languages and History.

Curriculum and Organisation.

The hours of work, including preparation and a period of Religious Instruction on Sundays, are $38\frac{3}{4}$ per week at Osborne, $43\frac{3}{4}$ at Dartmouth. These are slightly more than the regular hours of work at schools for boys of corresponding ages, but nearly one-fourth of the time is devoted to Engineering, mainly to practical work. Mathematics (including Navigation) gets nearly another fourth; Science and the Modern Language each about one-eighth; History, English, and Religious Instruction one-sixth; Seaman ship and Gymnastics account for the rest.

In judging this curriculum it must be remembered that not only will all the cadets have to make themselves efficient navigators and watch-keeping engineers, but also that many of them later on will specialise in Navigation, Engineering, Gunnery, or Torpedo, and that all these specialists will require a sound working knowledge of Mathematics or Science or both. For these a curriculum heavily biased in the direction of Science and Mathematics is essential; for the others who will not specialise a different curriculum is conceivable, but even if the future specialists could be separated from the others at an early stage, there would probably be on the whole more loss than gain in providing different curricula for the two classes. An occasional boy is indeed found who, while doing badly in Science and Mathematics, shows real ability in other directions. For such boys the curriculum of the Colleges is clearly not the best, but they seem to be rare, and for most of the cadets the actual curriculum probably provides as good a chance of mental development as any other.

The claims of these technical or quasi-technical subjects being so large, the time available for humane studies is small, and therefore demands the more careful use. It is clearly hardly possible to deal adequately with more than one foreign language, and an arrangement which allowed a section of the cadets to take up a second during the last two years of their course is being wisely discontinued in the light of experience. Half the cadets take French, half German; in both cases the aim is mainly utilitarian, and relatively little stress is accordingly laid on the literary aspect of modern language study. The main burden of representing the humanities therefore falls on the English and History. The whole time available for these two subjects, including preparation, is less than six hours per week. This is dangerously little, and clearly ought not to be reduced. On the other hand, the vital importance of a good use of this meagre time has been recognised, and while it would be unreasonable to compare

the literary training provided with that given on the classical side of a good school, it is probable that this recognition of the responsible position of History and English leads to better results than much of the traditional language teaching which so frequently fails to carry the pupil beyond the merely disciplinary stage.

With a curriculum so different from that in ordinary schools, it was, of course, difficult at the outset to draw up a detailed syllabus of the work to be done in the four years. The original syllabus, perhaps deliberately, to signalise the new departure, was drawn on somewhat ambitious lines; but it has been subjected to constant revision and reduction in the light of experience. Even now, as read by an outsider, it might appear to prescribe in certain directions a greater amount of work than the ordinary boy can be expected to master in the short time available, but its interpretation in practice does not seem to justify this apprehension to any serious extent. At the same time, the great danger to which the Colleges are exposed is the attempt to do too much in too short a time, or what comes to much the same thing, to attempt to exact practically the same work from all cadets irrespective of their various abilities.

It is true that within each "term" there is adequate subdivision into classes (normally four at Dartmouth, four to six at Osborne) and that the different classes in each term do not always, *e.g.*, in Mathematics or the Modern Language, attempt quite the same work; but the very proper desire to keep the chance always open to a cadet of sometime getting into a higher class has been a serious check upon letting each class go at its own natural rate. In all classes the pressure to get through the syllabus is more or less felt, and there is a constant danger of its driving the Masters, against their own better judgment, to teach too much and to leave boys too little chance of discovering and developing their own powers. Further, boys are kept very busy in one way and another outside the appointed hours of work, and there is therefore the less opportunity—so necessary for the full development especially of the abler boys—for individual reflection and study round the subjects actually treated in school hours.

Details as to the actual achievement in the various subjects will be found in the ensuing subject reports, but briefly it may be said here that the general impression is one of high efficiency; that the best work is very good, and that though there is a "tail," it is much smaller than would be found in most schools.

Each "term" is divided into two watches, the starboard watch being the more advanced at Osborne the port at Dartmouth. Each watch is further divided for most school-work into two, three, or four sections, so that classes are small (from 10 to 18, chiefly about 14). Each "term" is separately classified for each subject, so that good grading is possible. This system (which is quite essential to success) is rendered possible by the size of the Colleges, the uniformity of the curriculum, and by the fact that the number and qualifications of the staff are such as to enable all the work in each subject to be taken by competent men.

There are regular internal examinations at each College, which are conducted with great care, the reports written on each set of papers forming a useful permanent record as well as being serviceable for immediate criticism.

At the end of the whole course there is an External Examination. This, together with the term marks at Dartmouth (but not at Osborne), decides the order of passing out. On this an allowance of time is made to the more successful cadets, which accelerates their promotion to Lieutenant by one or two months. Although the final examination is in the hands of external examiners, great care is taken that it shall be suitable and that it shall not direct, but be directed by, the actual teaching. All the papers are submitted to the Head Master, who communicates his criticisms to the examiner. They are then sent on with the examiner's final draft of the paper to the Director of Naval Education.

SUBJECTS OF TEACHING.

English and History.

The teaching of English and History is on quite a different footing from the rest of the work of the Colleges. It is the object of the hours devoted to these subjects to provide that general education which is especially necessary, as the cadets enter at so young an age. More particularly, the object may be defined as (1) to give the necessary practice in writing and speaking English; (2) to give the power of reading and using books; (3) by the study of suitable works in literature and history to give that general acquaintance with the ideas and thoughts of mankind which is necessary to enable naval officers to take their place among the educated and cultured members of other professions. Some work of this kind is so obviously necessary as to need no justification.

The time allotted is the very minimum which can be considered in any way sufficient. Small as it is, it can, however, be made to suffice, if the work is really well done and the time properly used. To a very large extent this is the case, partly on account of the efficiency of the staff, partly because of the small size of the classes which contributes greatly to the effectiveness of the teaching; and, excluding some of the weaker cadets, the majority on leaving College give, by their attainments, clear evidence that the work is successful in attaining its object.

In both Colleges definite responsibility for organising courses and methods, and for supervising the work of their colleagues, is assigned to the Heads of the English and History Departments. These are in both cases experienced teachers and good organisers, and they have been successful in reconciling common aims on general principles with that freedom of detailed treatment which is essential to stimulating teaching in these subjects.

The staff of both Colleges is in general well selected and highly efficient; the Masters are further most conscientious and energetic in their revision of written work and in the preparation of lessons.

There are few schools in which the course of instruction has been so carefully worked out, and in which there is such harmonious co-operation between the different members of the staff.

English.

(a) *Osborne.*

English occupies a subordinate place in the curriculum, and the time assigned to it is unusually short. Including a Sunday period devoted to general reading of English authors, the total amount of time allowed for the subject varies from $2\frac{1}{4}$ hours a week in the four lowest "terms" to $1\frac{1}{2}$ hours a week in the Fifth and Sixth, together with half an hour's preparation once a fortnight. The special circumstances of the College may justify the adequacy of this allowance in the lowest "terms," but the reduction of time in the higher "terms" appears to be inconsistent with the importance of a thorough training in the mother-tongue, and of its bearing on the intelligent pursuit of other studies.

The course includes two elements which are sharply distinguished:—

- (1) Formal training in orthography, sentence construction, and the elements of English composition.
- (2) General reading of English poetry and prose from the point of view of literary interest. Here the recreative character of the work is deliberately emphasised, and the object is to inspire a taste for good literature.

The formal work is skilfully planned, and is carried out on the whole with much vigour and success. Formal grammar is reduced to a minimum. In this respect, however, there appears to be some need of differentiating between the highest and lowest sets of the first "term" on account of the great difference in the knowledge of fundamental notions of English grammar with which they enter the College, and it is suggested that a simple scheme as a ground-work for accurate writing should be devised for the latter in the first term.

In the teaching of composition the value of clear and complete oral answers is properly emphasised. The importance of this training cannot be overestimated, and its necessity is the more conspicuous in view of the very loose habits of speech and writing which the cadets show at the time of their admission. It was noted that, with one marked exception, the staff realised the necessity of themselves setting a good example of idiomatic English to their pupils.

The written work, though it has many excellent features, suffers on account of its complete dissociation from the general prose reading. Useful exercises in reproduction and paragraph construction are frequently set, but the essays on current topics are sometimes too difficult, and demand powers of generalisation inconsistent with the age and attainments of young pupils. In this connection it is felt that considerable benefit would be derived from the introduction of selections from good narrative prose, which would naturally suggest suitable subjects for composition and serve as good models for imitation.

The revision of the composition exercises is conducted with great discrimination and care. It is suggested, however, that the cadets should be regularly required to correct their mistakes, and that the time in which this is done should be utilised by the masters for individual criticism.

For general reading in English literature a series of well-selected texts in prose and verse is prescribed for Sunday reading. A school collection of English poems

is regularly used in the class-room for the purpose of reading and discussion, and forms the basis of many useful lessons, but the cadets are not required to learn by heart or to recite any English poetry.

(b) *Dartmouth.*

More prominence is given throughout this College to the teaching of English, and a more generous apportionment of time, amounting to two hours a week and one hour's preparation a fortnight, is allowed for the subject.

The system of departmental supervision by the responsible Master is the more necessary and beneficial in this case, inasmuch as there is a larger proportion of young and inexperienced Masters, and the qualifications of the staff are stronger on the historical than on the literary side.

The course of literature is one of considerable range and variety. Though some of the narrative prose works appear to be rather too elementary in character for this stage, the course as a whole is well-graded and judiciously selected. In prose, the prominence given to Macaulay's historical essays is justified both by their intrinsic interest and by the cadets' knowledge of general European History, to which they form a valuable supplement. In addition to these, good models of literary style are provided in selections from Addison, Gibbon, Burke, and Lamb; and, in verse, several Shakespeare plays are included, as well as selections from the poetry of Goldsmith, Wordsworth, and Tennyson. This course is designed for general reading, not for intensive study, and its object is to encourage the habit of reading good literature.

In contrast with the Osborne scheme, the Dartmouth syllabus lays definite stress on learning by heart and reciting English poetry, both on grounds of literary taste, and with a view to storing the mind, and giving it an unfailing source of pleasure.

An interesting experiment, recently instituted and deserving success, is the introduction of some translations from the Greek to supplement the course of English literature.

Composition is taught in accordance with a systematic scheme, which includes the structure of the sentence and paragraph, précis writing, letter writing, and exercises in continuous composition, essays, &c. Much ingenuity is shown in devising suitable exercises of a practical kind—possibly even too much of the available time is given to rather artificial exercises of this type—but in some cases the selection of essay subjects is not very happy. Insufficient use appears to be made of the cadets' general reading to supply subjects for composition. This could well be done without sacrifice of interest; it should, in fact, increase the interest of the books they read by stimulating independent thought on the subjects with which they deal, and result in a more intelligent appreciation of their content and style.

As a whole the work appears to be singularly successful in teaching the cadets to express themselves in clear and vigorous English, and in inspiring them with a taste for reading. To this end the excellent reference library contributes, and the practice of setting the older cadets to conduct investigations involving the use of books of reference provides a most valuable training. In intelligence and in the range of their general information the more capable sets compare very favourably with most boys of similar age who have been educated in Public Schools.

History.

(a) *Osborne.*

The course of work in History consists of two sections: (1) English and Foreign, (2) Naval history. There are each week three lessons of three-quarters of an hour.

(1) *English and Foreign.*—The general object of this course is to give a general outline of the History of England with a parallel study of the principal movements and episodes in European history. The idea of this is excellent, and while it is specially suitable to the education of the cadets, it is in some ways superior to the more specialised work in English history, which is all that is to be found in most schools for boys of this age.

In order to cover so large a field, it is necessary to concentrate the attention on a limited number of carefully chosen points, and for young boys there must be a clear and graphic presentation of the episodes. In most cases this is recognised and much teaching of very unusual vigour and interest was heard. In some classes the danger was not entirely avoided of laying too much stress on broad generalisations which were beyond the comprehension of the boys. This was especially noticeable in

dealing with the youngest boys, and the treatment of the subject for the first "term," the Roman Empire, was open to the criticism that it was too vague and included considerations which they could not be expected to understand. It was also noticeable, to some extent, in the treatment of the Renaissance period.

Another danger, which is especially felt among the weaker sets, arises from the amount of ground which is covered. Many boys do not bring with them any good knowledge even of the more elementary facts of English history, and for these, as well as for those who have less ability in the work, the course should be curtailed and some of it omitted, and more attention should be given to English history. The necessity of some simplification of the course is recognised by the Instructors, but there was evidence that it was in some cases not carried out with sufficient strictness. It is, in particular, suggested that the study of the nineteenth century should be postponed, for it can be better dealt with at Dartmouth when the boys are older, and the time given to it is urgently needed for revision of the early parts of the course. In general, not sufficient time seems to be given to revision.

Though the cadets have regular practice in answering questions on paper, they would probably benefit by training in the use of the note-book. For young boys, the notes must be of the simplest nature, and should at first be confined to maps, tables of dates, and other matters which can be put in a condensed form, but even in this form the making of notes would help the cadets in acquiring the habit of independent study.

Throughout the course, indeed, it is desirable that more attention should be paid to the drawing of maps illustrative of the history. An excellent historical atlas is used, and in the Fifth Term a special course is given on political geography. It is, however, suggested that the object of this would be better attained if it took a more prominent part throughout the whole of the course rather than being relegated to a single term. What is required, in fact, is not so much a special course of lessons on the principles of political and historical geography, for which, indeed, the cadets are not sufficiently advanced, but regular and systematic practice continued from term to term in the study of the map and the drawing of maps. At present too often their knowledge of the map seems to cease with the coast-line. The work on some of the more difficult parts of European history would be simplified if it was approached from the study of the atlas.

More might be done to illustrate the history by the reading of suitably selected authors.

(2) The treatment of Naval history seems very suitable. It is based on a study of the lives and exploits of the most famous seamen and serves the purpose of making the cadets familiar with the most striking episodes in English Naval history. No formal study of tactics is attempted, this would be quite out of place, but the boys learn what actually as a matter of fact took place in each of the battles, and thereby gain acquaintance with the language and point of view of the naval operations.

(b) *Dartmouth.*

At Dartmouth no study of English history is attempted, the work being confined to European and Naval history. There has recently been some alteration in the syllabus; the present system is that the work on European history begins with the Renaissance and Naval history with the Commonwealth, so that the cadets have good opportunity for studying the classical period in the development of the English Navy. The last two terms are assigned to the special study of the history of the nineteenth century and to general revision.

The scheme is an interesting and suitable one. It is, however, suggested that the ground to be covered in European history is much greater than in Naval history, and it would be desirable to give to it rather more time, instead of, as is now done, dividing the hours available equally between the two subjects. This change would probably not prevent the cadets bringing away with them a knowledge of Naval history just as good as they now have. The two subjects really overlap one another; and in the study of European history attention is directed chiefly to those aspects of it which explain the naval operations. Without more time, the cadets, however, have not, and cannot be expected to have, a sufficient knowledge of the general situation to understand the part played by the British Navy.

There are several ways in which such a re-arrangement might be made. In the first year, two terms might be given to the study of general European history, including incidental references to the naval operations, and for the third term, the whole time might be devoted to the naval operations, including in it incidental

revision of the previous work. It would probably be advantageous to give one whole term to a study of the revolutionary and Napoleonic wars, both from the point of view of general history and of Naval history, for at this period the two are so inseparably connected with one another that they can most advantageously be studied side by side.

The study of Naval history is to some extent impeded by the want of a suitable text-book ; this makes it necessary to give much time to the preparation of full notes and synopses, and increases a tendency common in the teaching--there is too much exposition, not enough work is done by the cadets themselves, and the questioning is often insufficient. It would be better that they should gain their knowledge by the independent reading of a well-written book, which would then serve as a basis for further explanation by the Master. The cadets bring with them from Osborne some knowledge of the principal battles and the more elementary parts of the subject ; it is rightly not desired here to give any dogmatic expositions of tactics ; the stress of the work is therefore thrown on a more careful study of selected battles, but more especially on the strategical importance of the main operations taken in connection with the general political and military situation.

An interesting supplement to the other historical work is given in the short course of Ecclesiastical history taken in the fifth term. The task of dealing with this in such a manner as to be helpful to the cadets is not an easy one. The difficulties would be best overcome if more stress were laid on the connection of Church history with the other aspects of history with which the cadets have some slight acquaintance. It should be connected as much as possible with the fundamental facts, such as the division of the Greek and Latin Churches, and also be copiously illustrated by reference to existing remains of ecclesiastical architecture both in England and abroad, with which the cadets are, or may hope in later years, to become acquainted.

General Conclusions.--In conclusion it seems to be desirable to summarise briefly suggestions which are made from a consideration of the courses in English and History in both Colleges :-

(1) There is a tendency in both Colleges for the teaching to assume too much the form of continuous lecturing ; the pupils are not required to do enough work for themselves, and there should be more questioning of the classes.

This arises partly from the industry and ability of the staff, partly (and particularly at Osborne) from the small amount of time devoted to preparation, partly (and more especially in History) from the amount of ground which has to be covered.

(2) There is room for some rearrangement of the parts of the syllabus assigned to the different Colleges.

(a) In the study of literature many of the prose authors, *e.g.*, Froissart and Prescott, which are read at Dartmouth, would be more suitable for Osborne, both because they would fit in more conveniently with the History scheme of that College, and because simple prose narrative of this kind is better adapted for younger boys.

Similarly, a good deal of the poetry learned in some of the earlier terms at Dartmouth should, if learned at all, be taken at an earlier stage. It would further appear that the practice of committing poetry to memory is one which is specially suitable for young boys.

In the same way, as has been indicated in the separate reports, some of the essays on general subjects that are attempted at Osborne should be postponed, and a considerable number of the ingeniously devised preparatory exercises in composition in vogue at Dartmouth would be more in place at Osborne.

(b) The rearrangement of the History course, which has already been begun, might with advantage be carried further to secure in Osborne a firmer grasp of the earlier portions of History and particularly of English history. Greater attention to historical geography as an integral part of the History teaching is desirable in both Colleges. It is necessary to give a warning against the tendency unduly to neglect English history. It is certainly wise not to attempt a full study of it and in particular to omit the study of constitutional points to which too often the attention of boys is chiefly directed. Mediaeval history may also be properly treated very briefly. Nor should any change be made in the general idea of the

course which includes European as well as English history. The objects of the course will not, however, be fully attained unless the cadets have a good grounding in the main points of English history during the last four centuries. English history must be the starting point from which foreign history is approached, and the study of Naval history cannot with impunity be dissociated from the general history of the country. Many cadets, however, leave Osborne and even Dartmouth without the necessary knowledge, fundamental matters such as the nature and course of the Civil War, the relations with Scotland and Ireland, are too scantily dealt with. It is clearly a reversal of the natural order that cadets who do not know the course of the Civil War in England should learn the campaigns of Gustavus Adolphus.

(3) The terminal tests especially for the older cadets do not afford an adequate test either in English or History of the best work of which they are capable, largely because insufficient time is allowed for the working of the papers.

In English, though not in History, the nature of the questions in the "passing-out examination" admits of criticism.

Geography.

Geography is specifically taught only at Osborne. The teaching is well organised and the Head of the Department has provided a set of excellent notes for the guidance of his colleagues. One and a half hours per week are devoted to this subject throughout the course. This is by no means excessive, but it has been made adequate by excluding from the syllabus all teaching of the causes which determine climate. For each region the climatic conditions are found from the data supplied by the atlas, and the effect of these on human activities is then discussed. This appears under the circumstances to be a wise course, and the resulting standard of knowledge in regional geography is excellent.

No text-book in Geography is in general use, but a note-book containing blank pages and outline maps is provided. These outlines are filled in to illustrate certain definite geographical points. This is an excellent plan, but the notes made by the cadets are very meagre and do not furnish a means of revision of earlier work. It is suggested that the cadets should write a concise summary of the main points of each lesson to be kept for future reference.

All the astronomical geography has been deferred to the sixth term, in which a special mathematical course is drawn up in preparation for the work at Dartmouth. As this course is in the experimental stage no definite opinion as to its merits can at present be offered; but it appears desirable that, in addition to this, some very simple work in the apparent movements of the sun and heavenly bodies should be undertaken in the first and second terms. This would materially assist the astronomical work of the sixth term and the more specialised studies at Dartmouth, and at the same time create a habit of observation of the everyday phenomena of the heavens, a habit which is curiously wanting even in the later terms. Few boys know the points of the compass with respect to the College buildings, or that the sun is in the south at noon. Most of them thought that the sun always rose directly in the east and set exactly in the west.

On the whole, however, the work in the Geography Department creates a most favourable impression.

Modern Languages.

The aim of the instruction is to enable the cadets to understand readily the spoken idiom, to use it accurately and with some fluency, to read modern literary texts intelligently, and to write simple continuous French or German with facility and correctness.

The conditions are exceptionally favourable to the realisation of this aim. The circumstances of the life and the interest of the work are of a character to attract the highest type of teaching. The age of entry is uniform, and all those under instruction are working to a common end. The organisation permits of classification into small and reasonably homogeneous sets. Under the new system the attention of the individual cadet is concentrated upon one language only, and the total time available is therefore in all cases sufficient to admit of the attainment of a satisfactory standard. The Modern Language Staff is enthusiastic and hardworking, and it includes Masters of skilled experience and high linguistic attainments.

In certain directions the aim of the instruction is reasonably well attained. By the end of the first two years a fair proportion of cadets acquire a quick understanding of the spoken idiom and a not inconsiderable power of oral expression. An increasing vocabulary enables continued progress to be made in these respects during the third and fourth years, but the method of treatment here adopted is not of a kind to effect a corresponding measure of improvement in lucid and precise exposition. Neither in facility of diction, nor in literary comprehension, nor again in correctness of elementary written work, is a standard attained such as might legitimately be expected in view of the ability of the teaching and the very favourable conditions of classification.

For this shortcoming various contributory causes may be assigned.

The difficulties peculiar to the teaching of a spoken language on the direct method are greatly augmented by the low standard of accuracy which characterises the written exercises at all stages of the course. This not only inevitably reacts upon the quality of the conversational work, but also tends to render more difficult the precise interpretation and full appreciation of the selected texts.

The harmony as to the ultimate aim of the teaching which marks the conduct of the two sections of the course at the respective Colleges is not fully reflected in the details of organisation and method. The co-ordination of the two halves of the course is not complete. A well-considered syllabus of grammar, followed during the first two years, is not continued, in any form, during the second two years; the high standard of pronunciation achieved at the close of the first stage is found to deteriorate somewhat in the latter part of the course; the sequence of reading books selected is not adequately graded in the matter of intrinsic difficulty; and valuable time and teaching are lost, after the transference from one College to the other, in the rediscovery of the actual level of attainment of the oncoming term. There is also some general misapprehension on the part of both the Departments concerned as to what may be considered the exact nature of their several complementary shares in the teaching of the languages; with the result that neither College is supplying that groundwork of grammatical accuracy, the substratum of concrete knowledge, without which the more liberal and literary treatment attempted in the latter part of the course lacks any sound basis for progress. In consequence, the books of wider interest, the freer composition, and the more idiomatic conversational work very rightly introduced in the later stages, are only adequately understood, or attempted, by a small proportion of the class. A further weakness, which the Modern Language Staff shares with the large majority of zealous teachers, lies in the extent to which the Masters take on themselves the whole burden of the work. The cadets do not get sufficient opportunity to acquire the habit of independent effort and thought, and the result is apparent as soon as they have to deal with even elementary tests where the guidance and stimulus of the instruction are momentarily withdrawn. The study of a Modern Language can be made interesting without the sacrifice of its service as an intellectual training. Even in a short practical course it is possible to combine the wider educational values of an introduction to literature and to the best recorded thought with the more directly utilitarian object of mastery of the spoken tongue, provided that a due proportion of the effort, and a steady and well graduated advance in the knowledge of the supporting structure of elementary linguistic facts and principles are simultaneously exacted from the pupils.

The tradition of strenuous and accurate work at the two Colleges is sufficiently vigorous, and the essential conditions of good material, able teaching, and adequate time, sufficiently favourable to render reasonable the expectation of a higher standard of result, and to justify the application of a somewhat critical judgment.

Mathematics.

In regard to Mathematics, the Colleges are fortunate in having as their Head Masters men who are themselves highly qualified in the subject (one of them in Science also) and who are able to give most effective help to their Heads of Departments, who also are highly qualified and most capable. The other Mathematical Masters form a strong staff, and the general level of teaching ability is high. The organisation of the work is excellent; weak points are speedily detected, and so far as conditions permit receive prompt attention. The syllabus of work departs widely from that which has been traditional in English schools, though modifications in the same general direction are now being made elsewhere. This has been necessary because Mathematics is here part of a boy's technical equipment. The time available

does not admit of the acquisition of this by the slow and deliberate methods which are possible in a long school and university course. Hence every part of the subject has had to be examined critically, and if it could not justify its retention by its necessity it has been cut out. Thus, to take a simple example, a thorough familiarity with the simplest parts of trigonometry is essential, but the whole algebraic development of the subject has been sacrificed. On the other hand, the arithmetical applications have been emphasised and much time given to their practice. Great importance is attached almost from the outset to familiarity with the use of logarithmic and other mathematical tables, to the handling and evaluation of such formulae as occur in engineering, but again the theoretical side of algebra has been curtailed, and little opportunity can be given for acquiring expertness in dealing with elaborate algebraic expressions or developing the sense of form. In geometry stress is laid chiefly on mensuration and drawing, and possibly the training in geometry proper has been thrust too much into the background. There can be no question that under the circumstances of the Colleges these departures from tradition have been necessary, and that in the main they are changes for the good of the average boy; whether or not in detail they have gone too far can only be decided by experience, and the staffs are quite competent to deal with this question.

A small amount of spherical trigonometry is necessarily taken because it is wanted for Navigation, but though the proofs of the few formulae required are gone through in class they are not learnt and even the formulae themselves are in many cases forgotten, all that is retained being the resulting scheme for the solution of spherical triangles. On the other hand, a good deal of attention is properly given to the elements of solid geometry so as to develop the power of space perception and the power of reading drawings. This is of course absolutely necessary for the engineering and to some extent for the navigation.

All boys get considerable training in graphic methods, and the abler ones something of co-ordinate geometry. The latter also get an excellent introduction to the calculus, great care being taken that the principles and ideas involved are thoroughly understood, though no great development of technical skill is possible. In Applied Mathematics important changes have been made recently. From the outset Mechanics has been dealt with primarily as an experimental subject, and it is still the case that it is studied first from this point of view in the laboratory. It has been found, however, that unless study of this kind is followed and followed immediately by the working out of numerical examples and the geometrical solution of problems its effect is apt to be evanescent. Accordingly mathematical study or practice of this sort now begins at Osborne in the term following the commencement of the laboratory work and is continued to the end of the first year at Dartmouth. The result promises to be a much firmer grasp of the subject and that without loss of the sense of reality given by the laboratory work.

In actual achievement, either as regards knowledge or power of thought, cadets, of course, differ greatly. As has been pointed out, definite provision is made at Dartmouth for the abler boys going further than the others. At Osborne this is not the case, all go over the same ground as far as possible, the weaker classes omitting only the harder examples and occasionally some small section of a subject. Whether the remissions for the weaker boys are sufficient is still doubtful. It is clearly not desirable to have a definitely reduced syllabus for them, but it is possible that each class ought to be treated more on its merits and given what it can properly master and no more, in spite of the apparent or real difficulties this might put in the way of a boy's promotion if later he showed development. It certainly is the case that there are boys who give the impression that they have gone too fast, and are out of their depth. On the other hand, the work of the better boys is very good and the general average is high. Much attention is rightly given to arithmetical accuracy; boys are trained to check their work, and though, of course, the general standard of accuracy is still far from that which is essential, say, in navigation, it seems to be decidedly higher than is usual at schools, and perhaps as high as is possible with boys before their work has been narrowed to the comparatively few types of operation and calculation which actually occur in any one walk of life.

Navigation.

Navigation as taught at Dartmouth consists of two distinct sections, viz. (1) Navigation and Nautical Astronomy taught by the professorial staff, and (2) Pilotage, including work on charts and compasses with the actual use of the sextant, taught

by one of the Naval Officers with the help of an Assistant Navigator. To the latter subject, naturally an introduction only is possible at the College, and much of the practical work and actual experience can only be obtained subsequently on the cruisers and at sea. It would clearly be to the advantage of the teaching if the lieutenant in charge of the subject could remain longer at the College than the usual naval period of two years.

The Navigation strictly so called is under the charge of a Naval Instructor as Head of Department; he is assisted by two other Naval Instructors, and to some extent by the Mathematical Staff. There seems to be no reason in the nature of things why any competent teacher of Mathematics should not deal with the subject, but so long as Naval Instructors are available it is natural to use them for this particular work to which they are most accustomed. The amount of Mathematics involved in the work (so far as taken at the College) is not great; the two difficulties are the need for thinking in space, and for a very high degree of arithmetical accuracy (and in the long run speed).

The work (except as noted above for the proofs of one or two formulæ) is well within the powers of the cadets; on the whole they seem quite to understand what they are doing; they are being trained to neatness and accuracy, but, of course, most of them will need a great deal of subsequent practice before the necessary standard will be reached in the latter respect.

Science.

The courses of work in Science at the two Colleges, supplemented as they are by the special courses in Applied Science on the training cruiser, have been drawn up with the view of securing that the cadets shall start their professional careers as midshipmen adequately equipped on the scientific side, to meet, so far as possible, the varied requirements of the Naval Service. For this purpose it has been necessary to take into account the needs of future specialists and non-specialists, of those who will give particular attention to gunnery and torpedo work as well as of those who will specialise as engineers. The courses are in practice necessarily determined by considerations connected with the ages of the cadets, their varying capacities, and the amount of time which can be spared for instruction in Science. Considerable modifications have been made from time to time in the detailed syllabuses of work, and it is understood that there is no finality about the present scheme.

This consists at Osborne exclusively of physics—easy mensuration, hydrostatics, mechanics, heat, and the introductory study of magnetism and current electricity being taken in turn. In mechanics and heat the work is further extended and developed on its technical side in the Engineering course. The latter subject is not included in the list of subjects studied at Dartmouth, though it appears in the scheme of work arranged for the cruiser. Chemistry and optics are taken successively in the first two terms at Dartmouth, mechanics is continued throughout the course, and electricity is taken up afresh in the third term, this and mechanics forming the subjects of instruction in the succeeding terms.

The general organisation of the work follows closely similar lines at both the Colleges. Each subject, with the exception of chemistry, is dealt with both in lectures and in the laboratory, the cadets of each term being classified for lecture purposes in small divisions according to their scientific abilities.

The lecture and laboratory courses are so far independent of one another that while the subject-matter of the laboratory course is covered in the lectures, the laboratory work in any portion of a subject never precedes and is often separated by a considerable interval of time from its treatment in the lecture room. The cadets, moreover, always work at their own pace in the laboratory where they are taken in large divisions of half a term under the supervision of three Masters, who are generally but not necessarily responsible for the lecture work of the cadets in question.

Ten Masters share the teaching at each of the Colleges, and in each case the staff as a whole are working loyally under a Head of the Department invested with sufficient control and full responsibility to the Head Master. Numerically the Science Staffs may be regarded as adequate; but their numbers cannot be considered excessive if small classes are to be retained and the laboratory work properly supervised.

It is a noteworthy feature of the work of the Colleges that there is to an unusual extent a frank interchange of ideas both among members of the Science Staffs themselves and also between the Science and Mathematical Masters. The close relations between the several members of the Science Staffs and the real control of the two

Heads of Departments have the salutary effect of maintaining a high level of teaching throughout, and of largely neutralising any individual weaknesses. The system by which certain of the Masters, who are primarily mathematicians, take part in the Science teaching, the Science Masters in their turn giving help in the teaching of Mathematics, has obvious advantages and is fully justified by the results of its practical working at the Colleges.

It is no less important that there should be close co-operation between the work of the staffs respectively responsible for Science and for Engineering; it would be a real assistance to newly appointed Masters unacquainted with the technical side of the cadets' work if they were enabled in the capacity of learners to visit the shops of certain engineering firms, or, better still, to take a course of practical engineering.

It has already been pointed out that the detailed syllabuses of work have been modified from time to time; the same is true of the practical course in each subject as set forth in the printed instructions for the separate experiments which the cadets carry out in the laboratory. Many of these experiments, notably those on kinetics, at Dartmouth, are original, and it is clear that the practical courses are constantly and critically considered in detail from the point of view of their suitability to the ends in view. The work of the Masters has in fact to a remarkable degree the note of vitality; and the teaching is as far as possible from being stereotyped or conventional.

With regard to the actual work of the cadets at the two Colleges, the general impression left on the Inspectors, based as this was both on questions asked in the laboratory and class-room as well as on an examination of the worked end of term papers, was that it reached a very satisfactory level and compared very favourably indeed with work done by the boys of these ages in any other schools in this country. The best papers done by cadets at Dartmouth in the senior terms are excellent, and though there were wide differences of standard among the cadets of any given term at both the Colleges, the number of poor papers was not so large as might have been expected in view of the large amount of ground that has to be covered and the difficulty of the questions set. The differences are greatest in the papers on mechanics, and correspond probably to differences in the cadets' mathematical abilities.

It is clear also that the cadets as a whole are taught to work intelligently in the laboratory, and though many were questioned it was rare to find a cadet who was not able to give a satisfactory and reasoned account of the experiment on which he was engaged.

The favourable view which the Inspectors formed of the work done at the Colleges must not be taken to imply a belief that there are not serious gaps in the knowledge even of the abler cadets at the end of their four years' course. That this should be so is not the fault of the teaching; it is rather a natural consequence at once of the extent and novelty of the work attempted and of a boy's capacity for forgetting. The point is, however, further dealt with below.

Good as the results in general are, it is thought that the possibility of making certain modifications of the general scheme might be considered with advantage:—

- (a) The features of the Science scheme which call most obviously for comment are the omission of chemistry from the course at Osborne, and the attempt to deal with a very full syllabus of work in this subject in a single term's lectures at Dartmouth. This is hardly to give to the study of materials and their interaction the importance which from the engineering and technical standpoint it certainly deserves. In the opinion of the Inspectors the cadets would gain if in their second year at Osborne the course of work included an introductory study of air and water, of the phenomena of combustion, and of elementary notions of chemical change, excluding chemical theory. Such a course would broaden the basis of the Science work, it would serve as an introduction to the further study of the subject at Dartmouth, and it would have the great advantage of spreading the work over a large period. It might then be possible to provide for the cadets at Dartmouth a more thorough study of those portions of the subject which are of special importance to the engineer, a knowledge of which, though it would appear to be postulated by the second and third terms' syllabus of the Engineering course itself, is not, and indeed cannot be, acquired under existing conditions.
- (b) If further time is to be found for chemistry some lightening of the existing syllabus will be necessary at Osborne. This might be effected either by the curtailment of the present syllabus in electricity or by the omission of

certain of the harder portions of the mechanics syllabus. In regard to the former alternative, it is recognised that there are great advantages in a system which involves a preliminary treatment of a difficult subject with subsequent repetition and extension.

(c) Optics is at present included in the Dartmouth course with the idea of giving the boys such a general knowledge of the subject as may help them to understand the sextant and the range-finder. Any necessary instruction might, it is thought, be given in connection with the practical working of the instruments themselves. In any case there does not appear to be any advantage in dealing with the elementary parts of optics in the lecture room as well as in the laboratory; and if the subject is included for its own sake in the Science scheme at all, its proper place would be in the first or second year's course at Osborne.

(d) The several subjects of the Science scheme are treated in separate compartments to which the cadets are successively introduced. As a minor point it may be noted that this sometimes involves taking particular sections of the work in a wrong order. Certain of the earlier portions of the mechanics course at Osborne, for example, the measurement of force and the idea of stress, might well precede the treatment of fluid pressures. It is more important to observe that an entire subject (like heat) may be dealt with at an early stage of the course and not again taken up, with the result that a good deal that has been learnt will have been forgotten by the time that a cadet passes out from Dartmouth--a process which is assisted by the omission of heat and hydrostatics from the passing-out examination. The difficulty might, it is suggested, be met by instituting regular revision papers (not confined to questions involving calculation) on all the back work for the cadets at Dartmouth.

Apart from the above suggestions on the scheme of work, two further points may be referred to in connection with the teaching methods employed, which are practically identical in the two Colleges:—

(a) Without raising any questions as to the theoretical advantages of the system by which laboratory and lecture work are dealt with quite separately as explained above (and it is realised that there is much to be said for the plan, at least in the case of older boys), the Inspectors are of opinion that the amount of lecturing at Osborne is excessive and that the teaching would in many cases have been more effective if the Masters had sometimes felt free to take their divisions in one of the laboratories and set the boys to work for themselves at the experiment under discussion. For younger boys such a proceeding, which does not of course exclude but rather invites subsequent discussion of the practical work done by the class, has advantages over the formal lecture; and the same note-books might well be used, both for "lecture" and "laboratory." With reference to the latter suggestion, it is to be observed that the "lecture" notes taken by the cadets at Osborne do not appear to be of much value, at any rate, for the purposes of revision.

(b) It is noteworthy that, except in the case of electricity, no text-books are used at either College. This would matter less if great care were taken to secure that the boys' notes, both of lecture and laboratory work, were sufficiently full and complete. But in the absence of a system of elaborate note-taking carefully supervised, or alternatively of text-books, revision of back work becomes difficult or impossible. It is an even more serious matter that the cadets should not be taught to read for themselves. If suitable text-books were provided, the periodical revision papers might well contain certain questions to be done with the help of books. In any case it would seem desirable that the cadets on passing into the Naval Service should have been trained to make an intelligent use of the standard technical and scientific works to which in their professional life on board ship they presumably have access.

The above report has dealt with the work of the two Colleges, taken as they must be together. From what they saw of the work of the two institutions, the Inspectors formed the decided opinion that the good Science work done at Dartmouth is alone made possible by the fact that the cadets have already undergone thorough instruction and training for two years at Osborne. No changes, however slight, can be made in

the Science work at Osborne without affecting the work at Dartmouth; and so far as instruction in Science is concerned, the interdependence of the two Colleges is an essential part of the scheme.

Engineering.

It may be well to preface any remarks on this part of the training by the statement that in making them the special aim of the course has been kept well in view. Some essential differences which exist between this course and engineering courses provided in day technical colleges throughout the country for youths who afterwards are to be engaged in constructive work or in designing have to be recognised.

In order to arrive at a fair estimate of what is being attempted and accomplished it is necessary to realise what is included under the heading "Engineering." The course comprises—

- (1) Lectures on marine engineering;
- (2) Engineering workshop practice, with explanatory lectures;
- (3) Special practical and experimental work (not tool work) on engines and machinery;
- (4) Hand-sketching and Drawing Office Practice.

To the above work nine hours a week are devoted, amounting to about one-fourth of the total time. Altogether about 600 hours are given to the subject during the two years spent at each College, of which about 100 are given to lectures.

In dealing with the character of the instruction it will be convenient to consider the different forms of work in the order in which they are set out above.

The syllabus of lectures in marine engineering at Osborne deals chiefly with the working and construction of different types of engines, boilers, and pumps, and of details of these. The amount of what may be termed theory is small, being practically confined to giving notions of heat, force, energy, power, and such an elementary knowledge of the properties of steam as will enable the cadets to form some idea as to what happens to this substance during its passage from the boiler, through the engine, the condenser, and back to the boiler. From a mere examination of the printed syllabus it would appear that an impossible task was being attempted, but when seen in operation it becomes clear that the subject receives a very elementary treatment, and that with the aid of the wealth of equipment to be found in the lecture rooms and workshops the syllabus in its present form is quite a workable one with boys between 12 and 14 years of age.

At Dartmouth the subject-matter of the lectures becomes more difficult. Portions of the Osborne syllabus have to be revised and treated in a fuller manner; there are additional types of engines and new classes of machinery to be studied, which demand not only a wider knowledge of mechanism, but also a fuller knowledge of the behaviour of steam, water, air, gas, oil, or other vapours, when employed as the working substance which drives an engine. More time has to be given to the study of indicator diagrams, and the subjects of fuel and combustion claim attention. On the whole, the Dartmouth syllabus, as recently revised, is still very full, and it contains quite as much theory as the cadets are able to grasp.

The lectures in Engineering, which are given by Engineer-Lieutenants, appeared to have been very carefully prepared, and were delivered in a clear manner. Possibly there were points of importance in the subject-matter of the lectures on which insufficient emphasis was laid, and probably the method of frequently questioning the cadets during lectures with a view to ensuring that the explanations have been fully grasped might with advantage be adopted to a greater extent. Here it may be noted that the advantages in employing Engineer Officers for this work may be so great as to make the plan an essential part of the whole scheme. But the practice of limiting the period of their employment in this capacity to two years is not without disadvantages, since it is a very short period in which to gain experience and the desirable degree of skill as a teacher.

Much of the time in the lectures has to be devoted to explaining the construction and working of machinery, necessitating the use of diagrams or blackboard sketches. These are copied by the cadets on one side of their engineering note-books, the other side of which contains printed notes on the subject of the lecture; any additional notes are dictated and copied by the cadets. For all practical purposes this note-book becomes their text-book. In the lectures, therefore, the cadets get little practice in taking notes in their own words. In view of the age of the cadets, the amount of ground to be covered, and the technical nature of the work, no other plan seems

practicable. In other parts of their work, however, they have practice in writing notes in their own words.

The provision for workshop instruction at the two Colleges, both as regards equipment and staff, is on a scale which is not attempted in any technical institution in the country, while the organisation of the work is as perfect as it well can be. Some 25 instructors are employed in the various shops, and with few exceptions they are men who still are, or have been, in active service as artificers in the Navy. There is evidence that they have been chosen with great care, and as some attended technical classes during their apprenticeship they are well qualified on both the theoretical and practical side.

The way in which the time is apportioned to the various workshops is shown in the table below. Columns 2 and 4 show the number of half-terms, while columns 3 and 5 give, roughly, the equivalent in working weeks of an ordinary apprentice putting in the same total number of hours as a cadet.

Number of Half-Terms spent in the different Shops.

Workshop	Osborne.			Dartmouth.	
	(1)	(2)	(3)	(4)	(5)
Carpenters' shop	-	-	1	1	-
Pattern shop	-	-	1	1	1
Foundry	-	-	1	1	1
Smithy	-	-	1	1	-
*Coppersmith's shop	-	-	-	1	1
Boiler shop	-	-	-	2	2
Drawing office	-	-	1	1	1
†Machine shop	-	-	7	5	6

At Osborne one week is spent in this shop.

† Part of the time assigned to this shop is spent on work other than tool work.

During the four years' course of workshop practice at the two Colleges the cadets acquire a valuable experience in the use of the ordinary hand and machine tools, a knowledge of the nature of materials, and such an insight into workshop processes as will give them a general idea of the manner in which parts of machinery are made and fitted together. From a glance at columns 3 and 5 in the above table it will be seen that the time spent in any shop is really very short, and some rough idea may be formed of the degree of practical skill which the cadets can reasonably be expected to acquire. While it is not easy to say whether this will prove to be sufficient to meet what will be required of them later in their career, it may be taken as fairly certain that the conditions which prevail in respect to equipment, staff, and organisation of the work, and the manner in which the cadets apply themselves to their work, are such that in the time assigned the best possible results are obtained.

At Dartmouth a portion of the time assigned to the machine shop in the fifth and sixth terms, amounting in all to about three weeks, is spent in the electrical workshop. In the fifth term the work consists in running circuits with lamps in parallel and in series, together with the necessary connections to fuses and switches; the jointing of lead-covered wires, the insulation and winding of coils, and the tracing of faults. In the sixth term, armature cores and commutators are built up, the armatures are wound, the end connections made, and the completed armature tested for faults. The work is well graded and arranged, and the cadets show a keen interest in their tasks. The equipment is liberal and the instruction given is of a practical nature throughout, and forms a valuable concomitant to the work in electricity done in the fourth, fifth, and sixth terms. The theoretical work in electricity would probably be strengthened by a still closer connection with the electrical shopwork.

Each cadet keeps a workshop note-book in which he makes sketches of machinery, and writes accounts of short demonstrations given by the instructors. At Osborne it was observed that in some of the shops cadets copied out instructions and information about materials and processes from typed sheets. In some cases this occupied time which might have been saved by supplying the cadets with printed copies.

The practical work of the cadets is well supervised by the instructors, and if considered unsatisfactory the work has to be repeated. The exercises themselves have been carefully drawn up, and are of a useful kind. At Dartmouth the parts of small engines have been made, and the engines erected by the cadets.

Reference has already been made to the fact that a certain part of the time nominally assigned to work in the machine shop is really devoted to certain pieces of special work. It is unnecessary fully to enumerate these, but, roughly, they consist of the opening out and examination of engines and machinery in the shops and in the various steam vessels, raising steam in the latter, running the engines, tracing pipes and fittings, boiler-room practice under way, setting slide valves, testing material, making engine tests, &c. The work is noteworthy as affording an example of good organisation, the cadets working in small batches of two to six or seven. It is extremely educative since it demands close observation, and involves sketching and written descriptions. Much of this work impresses and stimulates the cadets, and by means of it they learn much in a short time. It stands out as a distinct feature of the engineering work, and strikingly illustrates the possibilities of good equipment and an adequate staff.

Drawing forms an integral part of the work in Engineering. To many of the cadets on joining Osborne it is practically a new subject. The first few lectures in Engineering are devoted to showing them how to make freehand sketches of the plan, elevation, and section of a simple object. By daily practice in copying black-board sketches in the lecture room, by regular practice in sketching from machines in the workshop, and in reading the working drawings from which they construct articles in the workshop, the majority of the cadets quickly acquire facility in sketching, and as so large a proportion of the latter is done from actual machinery they also learn much about construction. Naturally, some show less aptitude for drawing than others, and for this reason it is important that more exercises of a simple and well-graded character should be provided at the beginning of the course.

In the fifth or sixth term at Osborne, and again two years later at Dartmouth, for a period of six weeks, practice in the drawing office replaces workshop practice. During this period the cadets learn how to make a working drawing to scale, and with the exception of one or two preliminary exercises to illustrate the general method of procedure, all scale drawings are made from dimensioned hand sketches of actual machine parts. At Osborne a little information about the proportions of the parts of nuts, screws, &c. is given, and at Dartmouth a little elementary design is attempted. The cadets are taught to make a tracing, and they receive a demonstration in the process of making blue-prints. The instructors are keenly interested in their work, and as the cadets have good instruments and are taught to keep them in proper working condition the quality of the draughtsmanship is all that could be desired. As regards this part of the work, there is nothing to learn from the best technical colleges, since in few of these are such sound methods so consistently adopted.

The four main sections into which it has been found convenient to divide the engineering work have been touched upon, and a few general remarks may now be made. It is practically certain that no ordinary Preparatory School could afford to provide the equipment and staff, and secure the effective organisation to be found at Osborne. And without these facilities and organisation it would be futile, not to say iniquitous, to attempt that degree of specialisation with boys of 12 years of age which is possible and suitable in the circumstances which prevail at Osborne.

In its present state the complete syllabus in Engineering is a little too full. The Osborne section can be worked through without any serious strain, because of its elementary treatment. The Dartmouth portion, that is, the part dealt with in the lectures, is rather a severe trial for a considerable section of the cadets, and further pruning is advisable. At these two Colleges, as at all others, there is, of course, a certain proportion of instruction which is not fully assimilated, though here this is not serious in amount. It should be observed that owing to the prescribed daily routine there is little time out of school hours in which to read and think over the more difficult theoretical portions, and to acquire a more thorough grasp of principles by working many numerical exercises. The engineering student at an ordinary

technical college finds it necessary to do all this, even though the time devoted to engineering subjects proper at his College will usually be nearly double that given at Dartmouth. On the whole, the number of numerical examples worked during the course is very small; apparently there is little time available for this kind of work. It is also noteworthy how small is the demand made by the engineering course at Dartmouth on the mathematical knowledge which the cadets acquire there; the demand made by the syllabus of work on the Cruisers is no doubt much greater.

It is certain that no form of the varied instruction given in the engineering course can well be omitted. The proportion of time given to lectures is not excessive, while the absolute amount given to lectures and to actual workshop practice is all too short, considering the extent of ground to be covered in the time.

General Conclusions.

The scope of the Inspection was limited to the actual work, the Inspectors being instructed not to deal with the discipline or with the buildings, nor were they asked to consider the important questions of over-pressure and the general care of the cadets. They are entitled to say, however, that so far as concerns the work itself, there are no obvious signs of over-pressure in the ordinary sense. It is true that the hours allotted to formal work are considerable, but the work is varied, and much of it of a kind not involving mental strain; further, school work is in practice strictly confined to the allotted hours, so that it cannot reasonably be held that it is excessive. The danger, so far as there is one, is not that of overwork, but of too much teaching and too little independent effort on the part of the cadets. This danger is inherent in the system which involves the attempt to cover an extensive syllabus in a strictly limited time. While it cannot be said that the danger is entirely avoided, the staff are well aware of it and take pains to avoid it, and on the whole with as much success as could be expected. Apart from this limitation of time, the conditions of education at the Colleges are very favourable; a single, well-organised curriculum, a large and highly capable staff, boys for the most part very willing to work and impelled by the desire to do well in the profession chosen for them. The great educational experiment (for such it is) has been tried under most favourable auspices, and, in the opinion of the Inspectors, has achieved even in its first years a very high degree of success. They feel also that, in the light of the experience gained, even better results may confidently be expected in the future.

Enclosure No. 10 in Third Report of Education Committee, dated 13th September 1912.

(Extract from Syllabus, dated March 1912.)

Now in Force.

TRAINING OF NAVAL CADETS.

The following Syllabuses show the subjects of instruction of Naval Cadets under the New Scheme of Training, from entry until they pass out of the Training Cruisers as Midshipmen. They include—

- I. Subjects of Study at the Royal Naval College, Osborne.
- II. Subjects of Study at the Royal Naval College, Dartmouth.
- III. Subjects of Study in the Training Cruisers.

The training of Naval Cadets begins at Osborne, where they spend two years each comprising three terms. They next proceed to Dartmouth for two years, and thence to a Training Cruiser for two terms. Then they go to sea as Midshipmen, and after three years' service in that rank they are examined for the Rank of Lieutenant. The limits of age at entry are $12\frac{2}{3}$ and 13. Cadets therefore become Midshipmen normally at age $17\frac{1}{3}$ - $17\frac{2}{3}$.

I.—ROYAL NAVAL COLLEGE, OSBORNE.

General Remarks.

The hours of study on week-days are as follows:—

7.15 a.m.—7.45 a.m. (winter); 7.0 a.m.—7.45 a.m. (summer).

9.0 a.m.—1.0 p.m., with a break of 15 minutes at 11.15 a.m.

4.15 p.m.—6.30 p.m. (winter); 2.15 p.m.—4.30 p.m. (summer).

Wednesday and Saturday are half-holidays.

The times of evening preparation are:—

Monday: 7.45 p.m.—8.15 p.m.

Tuesday, Thursday, Friday: 7.35 p.m.—8.5 p.m.

Wednesday: 7.30 p.m.—8.15 p.m.

On Sunday there is a Scripture lesson from 10 a.m. to 10.45 a.m.; and a period in the evening 7.15 p.m. to 8 p.m. is assigned to reading English books in class.

The normal "period" of study is 45 minutes; this is reduced to 30 minutes before breakfast (except in summer). Two consecutive periods are taken for Laboratory; and two, or more generally three consecutive periods for Engineering.

DISTRIBUTION OF HOURS PER WEEK (SUMMER ROUTINE).

	Sixth Term.		Fifth Term.		Third and Fourth Terms.		First and Second Terms.	
	Teaching.	Preparation.	Teaching.	Preparation.	Teaching.	Preparation.	Teaching.	Preparation.
Religious instruction	1 $\frac{1}{2}$	—	1 $\frac{1}{2}$	—	1 $\frac{1}{2}$	—	1 $\frac{1}{2}$	—
Mathematics	7 $\frac{1}{2}$	1 $\frac{1}{4}$	7 $\frac{1}{2}$	1 $\frac{1}{4}$	6 $\frac{3}{4}$	2	6 $\frac{3}{4}$	2
Physics	2 $\frac{1}{4}$	1	2 $\frac{1}{4}$	1	2 $\frac{1}{4}$	1 $\frac{1}{4}$	2 $\frac{1}{4}$	1 $\frac{1}{4}$
Laboratory	1 $\frac{1}{2}$	—	1 $\frac{1}{2}$	—	1 $\frac{1}{2}$	—	1 $\frac{1}{2}$	—
Engineering Lectures	1	1 $\frac{1}{4}$ *	1	1 $\frac{1}{4}$ *	1	1 $\frac{1}{4}$ *	1 $\frac{1}{2}$	1 $\frac{1}{4}$ *
Engineering Workshops	8	—	8	—	8	—	7	—
French or German	3 $\frac{3}{4}$	1 $\frac{1}{2}$	3 $\frac{3}{4}$	1 $\frac{1}{2}$	3 $\frac{3}{4}$	1 $\frac{1}{2}$	3 $\frac{3}{4}$	1 $\frac{1}{2}$
History	1 $\frac{1}{2}$	1 $\frac{1}{2}$	2 $\frac{1}{2}$	3 $\frac{1}{4}$	2 $\frac{1}{2}$	3 $\frac{1}{4}$	2 $\frac{1}{2}$	3 $\frac{1}{4}$
English	1 $\frac{1}{2}$	1 $\frac{1}{4}$ *	1 $\frac{1}{2}$	1 $\frac{1}{4}$ *	2 $\frac{1}{2}$	1 $\frac{1}{4}$ *	2 $\frac{1}{2}$	1 $\frac{1}{4}$ *
Geography	1 $\frac{1}{2}$	1 $\frac{1}{4}$ *	1 $\frac{1}{2}$	1 $\frac{1}{4}$ *	1 $\frac{1}{2}$	1 $\frac{1}{4}$ *	1 $\frac{1}{2}$	1 $\frac{1}{4}$ *
Seamanship	—	—	—	—	—	—	—	—
Signalling	—	—	—	—	—	—	—	—
Gymnastics	2 $\frac{1}{4}$	—	2 $\frac{1}{4}$	—	2 $\frac{1}{4}$	—	2 $\frac{1}{4}$	—
	33 $\frac{3}{4}$	5	34 $\frac{1}{2}$	4 $\frac{1}{4}$	34 $\frac{1}{2}$	4 $\frac{1}{4}$	34 $\frac{1}{2}$	4 $\frac{1}{4}$
	38 $\frac{3}{4}$		38 $\frac{3}{4}$		38 $\frac{3}{4}$		38 $\frac{3}{4}$	

* This represents half an hour in alternate weeks.

The winter routine differs from the summer routine in the following particulars:—

(1) As the period before breakfast is reduced from $\frac{1}{2}$ hour to $\frac{1}{4}$ hour, certain subjects lose time.

(2) In terms 6, 5, 4, the time given to gymnastics is reduced by $\frac{1}{2}$ hour per week, of which $\frac{1}{2}$ hour goes to French (or German) preparation, and $\frac{1}{4}$ hour to engineering preparation.

Religious Instruction.

OLD TESTAMENT.

First Year.—From the Call of Abraham to the Death of Moses.

Second Year.—The chief events in the Books of Joshua, Judges and 1. Samuel; The Book of Ruth.

NEW TESTAMENT.

A cycle of work, including The Gospels (1 year), Acts (1 year).

In all Terms.—Portions of the Psalms, and some Collects are learnt by heart. Catechism.

In Term 6.—Short lectures on the sources from which the books of the Bible have come to us.

Text books.—Bible; Life of Christ, Hillard; How we got our Bible, Smith.

Mathematics.

TERM 1.

Arithmetic.—Prime numbers; prime factors; vulgar fractions. Unitary method. Decimal fractions; the metric system. Degree of approximation. Areas of rectangular figures. Volumes of rectangular solids. Circumference and area of circle, surface and volume of cylinder.

Algebra.—Notation. Substitution of numbers in algebraic expressions. Simple equations; problems. Use of squared paper; graphs of statistics; graphs of simple functions (not necessarily linear). Operations with simple terms.

Geometry.—Use of drawing instruments. Drawing to scale; bearings; use of theodolite and azimuth compass. Simple geometrical solids. Fundamental facts connected with (1) angles at a point, (2) parallels. Exercises on these facts.

TERM 2.

Arithmetic.—Square root (1) by calculation, (2) from tables. Surface and volume of solids whose plan and elevation is given.

Algebra.—Graphical solution of equations; simple simultaneous equations. Fractions. Multiplication and division of polynomials. Factors. Solution of quadratics by factors. Graph of x^2 , and of $\frac{1}{x}$ with reference to indicator diagram.

Geometry.—Fundamental facts connected with (1) equality of triangles, (2) sum of angles for triangle and polygon. Isosceles triangle. Parallelogram. Constructions associated with them. Locus of points equidistant from (1) two given points, (2) two given straight lines.

TERM 3.

Arithmetic.—Ratio; percentage. Simple interest. Exercises bearing on engineering (pressure; pitch of screws; trains of wheels).

Algebra.—Equations involving algebraic fractions. Symbolic expression. Graphical solution of quadratics.

Geometry.—The circle—circumference, arc, chord, angle properties. Plotting of loci and envelopes.

Mechanics.—Graphical exercises on parallelogram of forces.

TERM 4.

Arithmetic.—Logarithms.

Algebra.—Fractional and negative indices, to introduce Logarithms. Solution of quadratic equation by completing the square.

Geometry.—Area.

Trigonometry.—Tangent, sine and cosine of acute angle. Tangent of general angle, and graph of the tangent. Solution of right-angled triangles.

Mechanics.—Exercises on resolution of forces.

TERM 5.

Algebra.—Solution of quadratic equation by use of formula. Simultaneous solution of two equations of which one is linear and the other quadratic. Variation.

Geometry.—The circle; tangent properties.

Trigonometry.—Solution of certain triangles by dividing into right-angled triangles.

Mechanics.—Exercises on moments (lever; centre of gravity).

TERM 6.

Algebra.—Surds. Graphical solution of equations of degree higher than the second with a few examples. General considerations as to graphical representation of data (choice of scale, &c.)

Geometry.—The circle. Extension of Pythagoras' theorem.

Trigonometry.—Sine and cosine of obtuse angle. Sine and cosine formulas in connection with triangle.

Mechanics.—Exercises on equilibrium under three forces.

Text-books.—The Winchester Arithmetic, Godfrey and Bell (Camb. Univ. Press). Elementary Geometry, Godfrey and Siddons (Camb. Univ. Press). Exercises in Algebra, Nettell and Hughes-Games (Longmans). Graphic Statics, Nettell (Arnold). Trigonometry for Beginners, Mercer (Camb. Univ. Press). 4-figure Mathematical Tables, Bottomley (Macmillan).

Physics.

Term.	Lectures.	Laboratory Work.
I.	Hydrostatics.	Mensuration.
II.	Mechanics.	Hydrostatics.
III.	Mechanics. Heat.	Mechanics.
IV.	Heat.	Mechanics. Heat.
V.	Magnetism.	Heat. Magnetism.
VI.	Electricity.	Magnetism. Electricity.

Hydrostatics.—The elementary properties of solids, liquids, and gases. Pressure in a liquid on a horizontal finite area. How the pressure in a liquid increases with the depth. The pressure on the base of a vessel containing a liquid is independent of the shape of the containing vessel (Pascal's vases). The principle of the Bramah press. Pressure in a gas. The existence of atmospheric pressure illustrated by simple experiments with the air pump. Measurement of atmospheric pressure; the simple barometer; the siphon barometer; the aneroid. The U-tube pressure gauge; measurement of the gas pressure in the Laboratory. Boyle's Law; the Thomson sounding machine. The principle of Archimedes. The specific gravity of solids and liquids. The principle of flotation; the common hydrometer. The common pump, the force pump, and the siphon.

Mechanics.—The use of the spring balance to measure force. Equilibrium of two forces which act on a body. Idea of stress; every force is one aspect of a stress. Resultant of forces which act on a body in the same straight line. The parallelogram of forces. The resolution of a force into two components in assigned directions, treated graphically. The triangle of forces. The principle of moments (levers, and similar examples); the conditions of equilibrium of a body free to rotate about a fixed point. The reactions at the points of support of a loaded beam. The resultant of parallel forces which act on a body in the same sense. Centre of gravity. Couples. Stable and unstable equilibrium. Elementary discussion of work, potential energy, and kinetic energy. The laws of friction for non-lubricated solids. Machines, more particularly a system of pulleys, the screw-jack, and Weston's differential pulley; velocity, ratio, and efficiency.

Heat.—The measurement of temperature by a mercury thermometer. The difference between quantity of heat and temperature. The effects of heat; rise of temperature, change of volume, change of state. The expansion of solids. The force of expansion (or contraction) exerted by a solid during change of temperature; rivets. The expansion of liquids; the relative expansions of different liquids. The mercury thermometer; its construction and graduation. Conversion of scales of temperature. The idea of heat as a form of energy; the methods of producing heat; the interchangeability of heat and work. The quantitative measurement of heat; heat units. Specific heats, by the method of mixtures. Change of state; the increase in volume when water freezes; the force of expansion when water freezes in a closed vessel. The measurement of the latent heat of fusion of ice. Evaporation; heat required for evaporation. Boiling. Boiling under reduced, and under increased pressure. Measurement of the latent heat of evaporation of water. Vapour pressure; behaviour of saturated vapours when subjected to changes of pressure and temperature. Total heat of formation of steam. Solution, distillation. Conduction of heat in solids and liquids. Convection currents in water and in air (with special reference to the heating of boilers and to ventilation). The effect of the nature of the surface of a heated body on the rate at which it loses heat.

Magnetism.—Magnetic attraction and repulsion. How to magnetise, and demagnetise, a steel bar. The difference in the behaviour of soft iron and steel under Magnetic induction: retentivity. Idea of the constitution of a magnet as made up of molecular magnets. Lines of magnetic force; mapping out of a magnetic field. Elementary discussion of the effects on a compass of the earth's magnetism (variation, dip); and of the effects of ship's magnetism, permanent and induced.

Current Electricity.—The simple Voltaic cell. Polarisation and methods of avoiding it. The Daniell cell, and the Leclanché cell. The magnetic field set up in the neighbourhood of an electric current. Solenoids. The electric bell. Resistance ; how the resistance of a conductor depends upon its material, length, and cross-section. The ohm. Resistance boxes. Measurement of the resistance of a conductor by the method of substitution. The chemical effect of a current ; electrolysis. The measurement of a current by a copper voltmeter. The ampère. Calibration of an ammeter by a copper voltmeter. Practical methods of measuring current. Electro-motive force ; the volt. Comparison of electro-motive forces by a high resistance galvanometer, or by a voltmeter. Ohm's law.

COURSE OF LABORATORY WORK.

The course consists of simple experiments bearing on the following subjects :—

1. *Mensuration.*—Simple measurements of length, area, volume ; use of the balance.

2. *Hydrostatics.*—The specific gravity of solids. The specific gravity of liquids. The principle of Archimedes. The principle of flotation. The measurement of gas pressures by a U-tube gauge. Boyle's law.

3. *Mechanics.*—The spring balance. Equilibrium of a body under the action of two forces. The parallelogram of forces. The triangle of forces. The principle of moments. Centre of gravity. The velocity ratio and efficiency of a system of pulleys, a screw-jack, and Weston's differential pulley.

4. *Heat.*—Measurements of the specific heats of solids and liquids by the method of mixtures. Measurements of the latent heat of fusion of ice, and the latent heat of evaporation of water. Measurement of the melting point of wax, and of the boiling point of water and salt solutions.

5. *Magnetism.*—Magnetic attraction and repulsion. Magnetic induction. Methods of magnetising and demagnetising a steel bar. The mapping of various magnetic fields.

6. *Current Electricity.*—The simple cell : local action and polarisation. The magnetic field in the neighbourhood of a current. Resistance of wires. Measurement of resistance by the method of substitution. Measurement of current by an ammeter, and by a copper voltmeter. Comparison of the electromotive forces of two cells.

English.

It is found undesirable to allot definite portions of the scheme to individual Terms. Arrangements are made to secure that the whole course shall be covered. It comprises :—

The etiquette of writing, e.g., handwriting, margins, use of capitals, hyphens, division of words at the end of a line, the possessive case, &c., &c.

Spelling and punctuation.

Dictation.

Reproduction (both oral and written) of a passage of English read aloud to the class.

Descriptions of all kinds.

Letters of all kinds.

Combination of sentences (to teach the correct use of conjunctions).

Expansion and condensation.

Direct and indirect speech.

Informal debates, followed by an essay.

Reading and explanation of selected prose and verse extracts.

Repetition of selected passages of English verse.

Word exercises—synonyms and opposites, simple prefixes and suffixes, diminutives, formation of words, distinction of meaning between words somewhat similar, discrimination between words closely allied in sense.

Text-book.—English poetry for schools, Cookson, (Macmillan).

History.

TERM 1.

The Roman Empire. Julius Cæsar and his adopted son. What the Roman Empire comprised. Britain: benefits of Roman Rule: a typical "provincie" (43-410). Christianity: why persecuted by Nero and others. Constantine. The ruin of the "provinces," *e.g.*, Britain. Coming of the English.

Benedict and the Monasteries.

The Monks in England: Augustine to Bede. The early church and its civilising influence. Conflict of British and Roman Christianity.

Mohammed.

The Franks and Charlemagne.

Charlemagne's pupil Egbert—Wessex under Alfred.

The Norsemen. Characteristics: types (Rollo, Cnut).

William the Conqueror.

Hildebrand. Power of the mediaeval Church: some references to Anselmo.

Naval History.—The lives of Hawkins, Drake, Howard and Grenville.

TERM 2.

Henry II. and Becket. The Angevin Empire. Brief review of England since the death of William I.

The Crusades.

John. Loss of France: quarrel with the Pope: Magna Charta.

Simon de Montfort and representative government.

England and Scotland. 1272-1333.

The Black Prince. Hundred Years' War, Part I.

The Earlier Renaissance (*a*) Dante (optional). (*b*) Wyclif. Need of reform in the Church. Lollards. Black Death and Peasants' Revolt.

William Tell. The Struggle for Swiss Independence.

Bolingbroke. Weakness and tyranny of Richard II. Hereford *v.* Norfolk. Bolingbroke's return and usurpation. Shrewsbury.

Hundred Years' War, Part II. (*a*) Henry V. Agincourt and Troyes. (*b*) Joan of Arc.

The Wars of the Roses (1455-1485). Margaret of Anjou: Warwick the King Maker: Richard III.

Naval History.—The lives of Blake and Albemarle.

TERM 3.

The Renaissance. (*a*) Lorenzo de Medici. (*b*) Michelangelo. (*c*) Savonarola. (*d*) Columbus; a word on the work of Ferdinand and Isabella.

Henry VII.

The Reformation. (*a*) Luther and Charles V. (*b*) Henry VIII. and Wolsey.

(*c*) Henry VIII. and Cromwell. (*d*) Edward VI. and Mary.

The Age of Elizabeth. (*a*) Mary, Queen of Scots. (*b*) William the Silent.

(*c*) Henry of Navarre. (*d*) Character of Queen. Her favourites. (Brief revision of the work of the First Year.)

Naval History.—The lives of Rooke, Benbow and Vernon.

TERM 4.

A link with the past. (*a*) Raleigh. (*b*) James I.

The Thirty Years' War. (*a*) Gustavus Adolphus. (*b*) Richelieu.

Charles I. His friends, Buckingham, Strafford, Laud. His enemies, Eliot, Hampden, Pym. Causes of War. The Civil War (a brief outline). Cromwell.

Age of Louis XIV. (1660-1715). (*a*) Louis XIV. Personalia. (*b*) Charles II. and the Restoration Settlement. (*c*) Shaftesbury. Habeas Corpus Act; Exclusion Bill; Sedgemoor; Bloody Assize. (*d*) The Revolution and the Bill of Rights. (*e*) William III. Land Battles. (*f*) Montagu. National Debt; Restoration of Currency; Bank of England. (*g*) Marlborough. Spanish Succession War (only Blenheim campaign in any detail). (*h*) Act of Settlement. Closing years of Queen Anne. The Hanoverian Succession. Union with Scotland.

Peter the Great.

Naval History.—The lives of Anson and Hawke.

TERM 5.

The "Fifteen" Rebellion.

Walpole. First Prime Minister. South Sea Scheme. Exchequer Scheme. Emphasise Peace interval (1713-1739).

The Young Pretender, and the "Forty-five."

(a) Frederick the Great. (b) Pitt and the Seven Years' War. An effort to group naval and continental aspects.

Clive.

George III. His character and aims. Bute and King's Friends. Corruption.

War of American Independence: causes. Saratoga and Yorktown.

Warren Hastings.

The Industrial Revolution.

The Younger Pitt. Include Union with Ireland.

The French Revolution.

Napoleon. His rise; Marengo, Austerlitz. Peninsular Campaign. His downfall; Austerlitz to St. Helena.

Naval History.—The lives of Keppel, Rodney and Howe.

TERM 6.

England after the Great War. Canning; Navarino; Catholic Emancipation.

Reform Bill and Chartism. Later extensions of the franchise.

Peel. Irish famine and Repeal of the Corn Laws. Modern tendencies of tariff legislation.

Crimean War. Later attempts at expansion by Russia.

Indian Mutiny and its results.

The Age of Napoleon III. (a) Regeneration of Italy: modern developments.

(b) Regeneration of Germany: modern developments. (c) Franco-Prussian War.

American Civil War. Causes. How was England affected?

Disraeli and Gladstone. The Imperialist and the Democrat. Suez Canal, Kaiser-i-Hind, Berlin Conference. Education of the masses (compulsory, free); Home Rule.

England in Egypt. Gordon; Cromer; Kitchener.

South Africa. Dutch settlements. England asked to help against the Zulus. First Boer War. Cecil Rhodes and Rhodesia. Second Boer War. Confederation of South Africa (*cf.* Dominion of Canada and the Commonwealth of Australia). Need of Confederation of the Empire: Difficulties.

Naval History.—The lives of Duncan and Nelson.

Text-books:—

Brief Survey of English History, Townshend Warner, (Blackie).

Scenes from European History, G. B. Smith, (Arnold).

Sea Kings of Britain, Callendar, (Longmans).

England in the XIXth Century, Oman, (Arnold).

New School Atlas of Modern History, Ramsay Muir, (Philips).

Geography.

Term I.—The British Isles.

„ II.—North America—Canada and U.S.A.

„ III.—Europe.

„ IV.—India and Australia.

„ V.—South America, South Africa, Egypt, China and Japan.

„ VI. —(Preparatory to Navigation) Mathematical geography; fieldwork.

Astronomy. Spherical geometry.

The general treatment in Terms I., II., IV. and V. includes:—

A preliminary examination of position, area and surface features.

Climate. There is no discussion of the many causes that determine the climate of a country. The basis of work is observation of main facts of temperature and rainfall as shown in the maps of the Atlas, followed by a study of their effect upon the conditions of human life in each country.

The bearing of the character of the surface-features and climate upon the resources of the country and its system of communications.

The effect of these resources (agricultural and mineral) upon the occupations and distribution of the people, past and present.

Finally, in the case of the countries that form part of the British Empire, a brief survey of their relations to the mother-country.

Topography is dealt with incidentally in the course of the above work.

This procedure may be illustrated by the following outline of the work of Term II. :-

N. America :-

The position; area.

The surface-features: the mountain and river systems in detail.

The climate: some comparison with that of the British Isles.

The chief producing areas—agricultural districts.

The mineral regions—industrial districts.

The natural and artificial communications affecting the above.

The distribution of the people in the above districts.

(In the case of Canada as part of the Empire.) Political connection with British Isles. Gradual development into self-governing dominion.

In Term III. the geography of Europe is taught with a double purpose, namely, to give thorough knowledge of the geographical features of the continent and to prepare the way for the History studied in later terms. It is shown how certain geographical features have influenced historical events, e.g., the influence of the sea, position, mountain barriers, passes, river valleys as centres of population and natural highways.

Text-books.—(1) Bartholomew's Comparative Atlas (Meiklejohn and Holden). (2) A geographical note-book containing outline maps (specially lithographed by Stationery Office).

French.

The main work of each class is based on a book selected for reading, which provides materials for conversation, grammar, drill, and dictation. Composition takes the form of writing answers to questions on a text, or the reproduction of a story read aloud. The Cadets are assisted in their reproduction by a skeleton containing the verbs in the infinitive mood and any hard or new words that may occur.

A piece of composition and an exercise in dictation are done once a week. The greater part of the remaining time is given to the reading book.

FRENCH GRAMMAR SCHEME.

I.—Feminine of nouns (regular). Plural of nouns (regular). Auxiliary and regular verbs. Feminine of adjectives (regular). Plural of adjectives (regular). Some common irregular verbs.

II.—Definite, indefinite and partitive articles. Agreement of adjectives. Demonstrative and Possessive adjectives. Numerals. Comparison.

III.—Feminine and plural of nouns (irregular). Feminine and plural of adjectives (irregular). Pronouns. Irregular verbs. Agreement of past participle. Subjunctive mood (elementary).

IV.—Gender of nouns. Nouns with two genders. Position of adjectives. Irregular verbs. Subjunctive mood. Sequence of tenses. Adverb. Preposition. Conjunction.

The portions of Grammar specified above are studied by the different classes according to the following scheme :-

Class.	Term					
	6.	5.	4.	3.	2.	1.
I	IV.	IV.	III.	III.	II.	I.
2	IV.	III.	III.	II.	II.	I.
3	III.	III.	II.	II.	I.	I.

German.

In the first year Grammar is taught inductively, the Cadets making their own grammars in note-books provided for that purpose.

In the second year suitable German texts are chosen, according to the capacity of the different classes. These are treated on modern lines, in the same way as in the case of French, and provide the material for conversation, composition, and grammatical instruction. The use of English is not rigidly excluded from the class-room, and is allowed whenever time would otherwise be wasted and whenever clearness and accuracy of knowledge would be sacrificed.

Cadets learn to read, but not to write, the German characters.

GERMAN GRAMMAR SCHEME.

Term I.

Declension of definite and indefinite articles. Declension of nouns. Present indicative of certain verbs.

Term II.

Declension of nouns. Declension of adjectives. Comparison of adjectives. Personal, relative, interrogative and reflexive pronouns. Possessive adjective. Prepositions with accusative, with dative, with accusative and dative. Present indicative of certain verbs.

Term III.

Declension of nouns. Prepositions. Irregular verbs (present, future, imperfect, and past participle).

Term IV.

Declension of nouns, adjectives, pronouns, &c. Comparison of adjectives and adverbs. Numerals. Pronouns. Verbs, active and passive. Strong verbs.

Term V.

Prepositions. Model verbs. Separable and inseparable verbs. Intransitive, impersonal and reflexive verbs. Word order. Strong verbs.

Term VI.

Conjunctions. Indirect speech. Indirect questions, commands, or wishes. Strong verbs.

TEXT-BOOKS: *French*.—Grammaire Élémentaire, Poole, (Murray). Picture Vocabulary, Poole, (Murray). Dictionnaire, Gazier, (Colin). Textes et Questions, Poole and Lassimonne, (Murray). Reading books, which vary from time to time.

German.—1st year. Dent's New First German Book, (Dent).

2nd year. Dent's Exercises in Grammar and Word Formation, (Dent). Reading books, which vary from time to time.

Engineering.

(A.)—LECTURES.

1st TERM. 23 Lectures.

Elementary mechanical drawing. Engines and boilers. Introductory definitions of energy, force, &c. Pressure. Methods of obtaining and use of pressure in engines. Reciprocating, rotary and oscillating motion. Double acting reciprocating engine. Single acting reciprocating engine. The crank. Dead centres. Use of fly-wheel. Rotary engines. Turbines. Consideration of forces acting on different parts of a structure. Compression. Tension. Bending. Shear. Torsion. Forces acting on various parts of a reciprocating engine. Necessity for crosshead slipper and guide. Bearings. The screw. The screw propeller. Method of securing parts of an engine. Methods of preventing nuts from turning. Keying. Couplings and clutches.

Workshop Lectures.

1. Carpenters' tools and materials.
2. Simple tools and materials in machine shop.

2nd TERM. 23 Lectures.

Bearings. Lubrication and lubricators. Methods of taking up wear in bearings. Pawl and ratchet. The eccentric. Cocks and valves. Simple slide valve without lap or lead. Differential valves. Piston valves. Non-return valves. Force and lift pumps. Cams. Cycle of 4-stroke internal combustion engine. Methods of keeping piston steam tight in cylinder. Stuffing box and gland.

Workshop Lectures.

1. Shapes and names of simpler cutting tools.
2. Wheel gearing of lathes. Simple screw cutting.

3rd TERM. 12 Lectures.

- (a) The boiler. Water tank and water tube boilers. Advantages and disadvantages of each type. Principal boiler mountings and fittings. Feed pumps. Condenser and fittings.
- (b) Gearing: Definitions. Pulley gearing. Spur wheel gearing. Helical wheels. Double helical wheels. Bevel wheels. Mitre wheels. Worm and worm wheel. Materials used in construction. Wrought iron. Cast iron. Steel. Copper and its alloys.

Workshop Lectures.

1. Compound gearing.
2. Lathe and machine tools. Drills and milling cutters.

FOURTH TERM. 12 Lectures.

- (a) Effect of heat on materials. Expansion joints of pipes and cylinder liners. Force. Work. Power. Energy. Boyle's law. Graphical representation of work. Effect of back pressure. The indicator. Indicator diagrams. Calculation of work done from area of diagram. Calculation of I.H.P. Expansive working of steam. Slide valve with lap and lead. Angular advance of eccentric. Modification of pressure volume graphs due to action of slide valve.
- (b) Screw cutting. Trains of wheels. Lathe back gear.

FIFTH TERM. 12 Lectures.

Small engine installation. Explanation of construction of return tube boiler and necessity for staying. Detailed sketches of fire tubes, dog stays, &c. Points to be aimed at in the design of a boiler; shape, combustion, heating surfaces, circulation, and steam space. How applied in case of return tube boiler. General conclusions. Difference between fire tube and water tube boilers. Water tube boilers. Describe and sketch large and small tube boilers, one of each type. Advantages and disadvantages of water tube boilers. Reasons for employing different types of boiler for different classes of work. Revision of boiler mountings. Describe and sketch condenser. Describe circulating pump and air pump, causes of loss of vacuum. Describe: -Feed pumps, feed tank, reserve feed tank, and evaporator. Causes of loss of feed water.

SIXTH TERM. 12 Lectures.

Heat. Vapours. Recapitulate 4th Term Lectures (work, horse power, advantage of expansive working, slide valves, indicator diagrams). Work obtainable from expansion of steam in a cylinder theoretically: chief causes of loss in practice. Cylinder clearance volume and its effects. Reduced power working: throttling and linking up. Cylinder condensation loss. Stage expansion and cylinder jacketing. Superheated steam. Steam turbines. Construction and working of Parson's turbine. Impulse and reaction. De Laval turbine. Single stage reaction. Many stage reaction.

FOURTH, FIFTH AND SIXTH TERMS. Workshop lectures.

Machine Shop.

- (1) Chucks, method of holding work in lathes and machines. Cutting tools for screw threads ("V" shaped and square) cutting double-threaded screws. Necessity for catching proper threads when returning slide rest.
- (2) Shaping, slotting and drilling machines.
- (3) Practical explanation of feed, vice and table mechanism of the above machines.

Brass Foundry.

One lecture on Foundry practice.

Pattern Shop.

One lecture on pattern making, tools and materials.

Smithy.

One lecture on forges, tool heats for working metals. Tempering. Case hardening.

B).—PRACTICAL WORK.

FIRST TERM.

Weeks.	Shop, &c.	Nature of Work.
6	Pattern Shop	Names of tools, gauges, &c. used in carpentering. Mortice and tenon, jointing, dovetailing. Make a box. Simple wood turning. One week of above spent in H.M.S. "Eclipse" acquiring general information with regard to ship and machinery.
6	Machine Shop	Chipping wrought iron, cast iron and gun metal with cold chisel and cross-cut. Filing same. Mark off and file up centre punch from round.

SECOND TERM.

12	Machine Shop	Cut out callipers from sheet, file up, bend, turn pin and washers for same. Cut nut gauge out of sheet iron, and file up to correct angles. Simple lathe work; commence lathe screw cutting. Use of stocks, dies and taps.
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THIRD TERM

9	Machine Shop	Make carriers, turning bolts and cutting threads in lathe. Lathe work with screw cutting. Use of shaping, slotting and drilling machines. Mark off and shape link blocks by machine. "Marking off" instruction 2 days.
1	Instructional Engines	Open out cylinder, draw piston and piston slide valves.
2	Instructional Steam-boat "Beta."	Open out air pump; sketch condenser ferrules; see main bearing adjusted with leads.

2	Instructional Steam-boat "Beta."	Eight days harbour instruction: two days steaming. Sketch boiler and air pump. Instruction in preparing for sea, warming through and steaming, manoeuvring engines under steam; boiler feed, &c.
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FOURTH, FIFTH AND SIXTH TERMS.

9	Machine Shop	General bench, lathe and machine work. Turning and fitting cocks and valves; fitting tongue piece to piston ring; turning, machining and bedding brasses on pins, &c. Engine adjustments.
3	Machine Shop (Special Lathe Class)	Screw cutting. Square thread cutting. Preparing tools. Boring out brasses. Turning eccentric straps, &c. Sketching mechanism.
6	Foundry	Simple castings in brass, cocks, valves, glands, brasses, &c. Burning on. Mould for sheave. Use of cores.
6	Drawing Office	Mechanical drawing. 1-inch bolt and nut. Spanner. Valve wheel. Vice screw. Piston rod. Sun prints.
6	Smithy	Round bar to square. Square bar to round. Hexagon taper drift. Scarfing and welding. Making links. Make pair of tongs. Tempering.
6	Pattern Shop	Simple patterns of bolts, glands, brasses, eccentric sheaves and straps with core prints and core boxes.

During above time Special Classes are taken as follows:—

FOURTH TERM.

One week Sketching class. Sketch bolt with nut in section. Elevation and section of straightway cock. Spanners. One week Coppersmith's shop. Simple tinning and soldering. Use of fluxes. Remettling small brasses.

FIFTH TERM.

Three days Torpedo boat, two of which are spent under steam. Preparing for sea. Lighting up and warming through. Engine and boiler room practice under

way. Action taken in case of burst tube, loss of water, loss of vacuum, &c. One day setting eccentricities of engines in shops to correct angle of advance.

Examinations in practical workmanship (by means of test jobs) are held twice a term for all Cadets.

WORKSHOP CYCLE.

The Cadets of each term are divided into four groups for instruction in Engineering, A and B being the first and second parts of the Starboard Watch, and C and D the first and second parts of the Port Watch.

Term.	First.	Second.	Third.	Fourth.	Fifth.	Sixth.
Part - - -	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D
First Half Term	P P P P	M M M M	M M M M	F M M S	O M F M	M S O M
Second Half Term	M M M M	M M M M	M M M M	M F P P	S O M F	P P S O

M = Machine Shop.

P = { Pattern Shop, or
Carpenter's Shop.

S = Smithy.

F = Foundry.

O = Drawing Office.

Seamanship.

FIRST TERM.

Bends and hitches - - - } 9 hours.

Per Term.

Per Term.

Signals, Semaphore and Morse 9 hours.

SECOND TERM.

Knots and splicing - - - } 9 " "

Signals, Semaphore and Morse 9 "

THIRD TERM.

Splicing - - - } 9 "

Signals, Semaphore, Morse, and
Flags - - - - - 9 "

FOURTH TERM.

Sounding machine - - - } 4½ "

Signals, Semaphore, Morse, and
Flags - - - - - 9 "

Rigging shears, lead - - - } 4½ "

Rule of Road - - - } 4½ "

FIFTH TERM.

Anchor work - - - } 4½ "

Signals, Semaphore, Morse, and
Flags - - - - - 9 "

Compass and charts - - - } 4½ "

SIXTH TERM.

Résumé of former instruc-
tions - - - - } 4½ "

Signals, Semaphore, Morse, and
Flags - - - - - 9 "

Cutter instruction - - - } 1½ "

Semaphore.—Making and reading with
hand flags.

Morse.—Making and reading with flag
and lamp.

Flags.—Colours and simple meanings
of all flags and pendants, Service code

II.—ROYAL NAVAL COLLEGE, DARTMOUTH.

Distribution of Hours per Week.

	Sixth Term.		Fifth Term.		Fourth Term.		Third Term.		Second Term.		First Term.	
	Teach.	Prep.	Teach.	Prep.	Teach.	Prep.	Teach.	Prep.	Teach.	Prep.	Teach.	Prep.
Religious Instruction	1 $\frac{3}{4}$	—	1 $\frac{3}{4}$	—	1 $\frac{3}{4}$	—	1 $\frac{3}{4}$	—	1 $\frac{3}{4}$	—	1 $\frac{3}{4}$	—
Mathematics (Pure)	4 or 3	2 $\frac{1}{2}$, 2 or 2 or 2 or 1 $\frac{1}{2}$	4 or 3	2 $\frac{1}{2}$ or 2 or 2	4 or 3	2 $\frac{1}{2}$ or 2	4	2	5	2 $\frac{1}{2}$	5	2 $\frac{1}{2}$
Navigation	2 or 3 or 4	1, 1 $\frac{1}{2}$ or 2	2 or 3	1 or 1 $\frac{1}{2}$	2 or 3	1 or 1 $\frac{1}{2}$	1	2	—	—	—	—
Applied Mathematics	—	—	—	—	—	—	2	—	2	—	4	1 $\frac{1}{2}$
Chemistry	—	—	—	—	—	—	—	—	—	—	4	1
Optics	—	—	—	—	—	—	—	—	—	—	—	—
Mechanics	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$
Electricity	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$
Laboratory	2	—	2	—	2	—	2	—	2	—	—	—
Engineering Lectures	1	1 $\frac{1}{2}$	1	1 $\frac{1}{2}$	1	1 $\frac{1}{2}$	1	1 $\frac{1}{2}$	1	1 $\frac{1}{2}$	1	1 $\frac{1}{2}$
Engineering Workshops	8	—	8	—	8	—	8	—	8	—	8	—
French or German	4	2	4	2	4	2	4	2	4	2	4	2
History	2	1	2	1	2	1	2	1	2	1	2	1
English	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$	2	1 $\frac{1}{2}$
Charts and Instruments	1	—	1	—	1	—	—	Some in Mathematics' time.	—	—	—	—
Seamanship	1 $\frac{1}{2}$	—	1 $\frac{1}{2}$	—	1 $\frac{1}{2}$	—	2	—	2	—	2	—
Gymnastics	1 $\frac{1}{2}$	—	1 $\frac{1}{2}$	—	1 $\frac{1}{2}$	—	2	—	2	—	2	—
	34 $\frac{3}{4}$	9	34 $\frac{3}{4}$	9	34 $\frac{3}{4}$	9	35 $\frac{3}{4}$	8	35 $\frac{3}{4}$	8	35 $\frac{3}{4}$	8
	43 $\frac{3}{4}$		43 $\frac{3}{4}$		43 $\frac{3}{4}$		43 $\frac{3}{4}$		43 $\frac{3}{4}$		43 $\frac{3}{4}$	

In the summer term the working hours are 7.0 a.m. to 8.0 a.m., 9.0 a.m. to 11.0 a.m., 11.15 a.m. to 1.15 p.m., 2.30 p.m. to 4.30 p.m. and 8.0 p.m. to 8.55 p.m., but there is no work on Wednesday afternoon, nor on Saturday afternoon and evening. In the winter and spring terms the hours are the same except that the afternoon work is from 4.30 to 6.30, and from November 1st to February 28th the hours are 7.20 a.m. to 8.10 a.m., 9.5 a.m. to 11.5 a.m., 11.20 a.m. to 1.20 p.m., 4.30 p.m. to 6.30 p.m. and 8.0 p.m. to 8.55 p.m.

Preparation goes on from 8.0 p.m. to 8.55 p.m., on some mornings from 7.0 to 8.0, and in the summer term on some afternoons from 2.30 to 3.30. On Monday evenings cadets do their preparation with their tutors, at other times under the charge of an officer or master, except in the case of the sixth term.

The normal length of the period devoted to a subject is an hour, but laboratory work occupies two consecutive hours, and engineering occupies three groups of two and one of three consecutive hours. Gymnastics occurs at any period of the day except before breakfast and in the first hour of the afternoon; religious instruction either from 7.0 a.m. to 8.0 a.m. or 9.0 a.m. to 10.0 a.m. The time table is arranged to provide work in as great a diversity of subjects as possible each day.

On Sundays religious instruction is given from 9.45 a.m. to 10.30 a.m.

Each term of cadets, numbering generally from 60 to 70, is divided into four classes, according to proficiency; during nearly all the hours of study the cadets of any one term are working at the same subject, so the distribution into classes depends on proficiency in that particular subject. In most cases the time allotted to the various subjects is the same for all classes in a term and the abler cadets cover rather more ground than the minimum laid down for the least able, as is shown in the syllabus; but in order to ensure that all should attain to the standard in navigation necessary on passing out, extra time is provided as required for the weaker cadets in this subject at the expense of their further progress in mathematics.

Mathematics.

Algebra and Arithmetic.—Mensuration of circle, cylinder, prism, cone, pyramid, sphere. Simpson's rule. Use of logarithms. Revision of Elementary Algebra. Miscellaneous equations and problems. Use of squared paper in solution of equations, in finding maxima and minima, in finding the approximate law connecting two variables, when it is of the form $y = ax + b$. Easy Surds and Indices. Variation.

Geometry, Plane.—Revision exercises on parallels, triangles, and circles. Ratio and proportion. Properties of similar figures.

Geometry, Solid.—Meaning of angle between two planes, and of angle between a line and a plane. Meaning of x , y , z , co-ordinates. Easy examples from the common solids. Measurement of sides and angles of spherical triangles by actual drawing on a sphere. Simple exercises in plan and elevation.

Trigonometry, Plane.—Solution of triangles; areas; proofs of formulas. Problems in heights and distances. Use of traverse table for solution of triangles. Circular measure. Trigonometrical ratios for angles of any magnitude. Equations—some graphically. Meaning of Inverse Notation. The more able cadets to do also: addition and factor formulas; a few identities and simplifications.

Trigonometry, Spherical.—See Navigation Syllabus.

Text-books.—Godfrey and Siddons' "Elementary Geometry," Mercer's "Trigonometry for Beginners," Nettell and Hughes-Games' "Exercises in Algebra."

HIGHER MATHEMATICS.

(For the more Advanced Cadets.)

ALGEBRAICAL GEOMETRY.

Straight Line.—Interpret constants in $y = mx + n$. Equation of line through given point with given gradient; Equation of line joining two given points. Conditions of parallelism and perpendicularity. Length of perpendicular from (h, k) to $ax + by + c = 0$.

Loci.—Equation of locus of point moving so as to satisfy certain geometrical conditions. Note specially circle in forms $x^2 + y^2 = r^2$, $(x - h)^2 + (y - k)^2 = r^2$, $x^2 + y^2 + ax + by + c = 0$.

Parabola.—Focus-directrix definition. Equation in forms—
 $y = ax^2$, $y - k = a(x - h)^2$, $y = ax^2 + bx + c$.

Ellipse.—Focus directrix definition. Equation in form $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. Relation to circle $x^2 + y^2 = a^2$.

With help of calculus, consider some geometrical properties of curves whose equations are given.

Calculus.—Elementary notions with illustrations from dynamics (speed) and geometry (gradient), &c. Differential coefficient of x^n . Use in (1) finding tangents at given points of $y = f(x)$; (2) finding speed at end of given time; (3) finding rate of growth of y , given that of x ; (4) finding maximum and minimum values; (5) finding approximations. The inverse operation. Area as limit of sum of rectangular strips: $\frac{dA}{dx} = y$. Meaning of notation $\int_a^b f(x) dx$. Application of integral calculus to areas, volumes of revolution, moments of inertia, centre of gravity, &c. Differentiation of the trigonometrical functions, product, quotient, and function of a function. Inverse function. Differentiation of e^x and $\log_e x$.

Text-book.—Mercer's "Calculus for Beginners."

Navigation.

SECOND TERM.

Spherical Geometry.—Geometry of the sphere. Systems of circles connected with an axis. Geographical and astronomical names of these circles. Practical work on the globe. Construction of spherical triangle on the globe. Polar triangle.

THIRD TERM.

Spherical Trigonometry.—The Fundamental formula. The Natural Haversine formula. The Logarithmic Haversine formula. Solution of spherical triangles by these formulas.

Navigation.—The Formula "Dep. = (d. Longitude) (cos. Latitude)." Middle latitude sailing. Taking a departure by bearing and distance. Finding course and distance to a destination. Working up dead reckoning from note-book entries.

Pilotage.—First ideas of a chart; different methods of fixing on a chart.

FOURTH TERM.

Spherical Trigonometry.—Application of formulas to great circle sailing. Application of formulas to simple astronomical problems. Right-angled and quadrantal triangles, treated as special cases of general triangle. Sunrise and sunset. Amplitude table.

Navigation.—Mercator sailing. Correction and conversion of courses. Revision of Middle Latitude sailing.

Variation and Deviation of Compass.—Variation due to earth's field. Its value taken from the chart.

Deviation due to ship's field. General ideas of effects produced, dealing with red and blue poles as in Admiralty Manual. Deviation table made by swinging ship. Constant checking necessary by taking sights at sea. Explain how ship acquires permanent magnetism while building. Given ship with red or blue permanent pole in a definite position indicate in a diagram the nature (E. or W.) of resulting deviation. State on which courses deviation (due to permanent magnetism) is nil and a maximum. Hence, with a given maximum value of deviation draw a sine curve, showing value of deviation for any given course. Permanent magnetism produces semicircular deviation. Induced magnetism in vertical soft iron also produces semicircular deviation. Induced magnetism in horizontal soft iron produces quadrantal deviation. Permanent magnetism corrected by permanent magnets in binnacle. Effect of vertical soft iron corrected by Flinder's bar. Effect of horizontal soft iron corrected by spheres.

Pilotage.—Construction (in pencil) Mercator's charts, including all fixes; application of deviation and variation.

FIFTH TERM.

Spherical Trigonometry and Navigation.—Revision. Prime vertical tables.

Astronomy.—Meridian altitudes of sun and stars. The Astronomical triangle. Sun's declination and equation of time: their correction for given Greenwich mean time. Sextant altitude of sun: corrections in altitude from tables. Solution of Astronomical Triangle for zenith distance and azimuth. Obtaining position line from dead reckoning, deck watch time and sextant altitude of sun. Determination of deviation from altitude-azimuth.

Pilotage.—Construction of charts (continued). The sextant; its parts; how to measure an angle with it; reading on and off the arc; practical methods of ascertaining errors and adjusting.

SIXTH TERM.

Navigation and Astronomy.—Fixing ship's position by a sun-sight and simultaneous bearing plotted on a skeleton chart. Chronometer and deck watch: Error and rate. Determination of chronometer error by altitude of sun, using artificial horizon. Revision of previous work.

Pilotage.—Practical fixing, laying off courses, and thoroughly understanding a printed chart. Proofs of optical properties of sextant and artificial horizon, and index error; measuring a single altitude of sun in an artificial horizon; measuring horizontal and vertical angles with sextant. Kelvin (Thomson) and Chetwynd compasses; their construction; practical methods of taking bearings. The use of a chronometer. Tide tables; methods of finding time and height of high and low water at standard ports.

Science Scheme.

FIRST TERM.

CHEMISTRY.—Lectures: 4 hours per week.

APPLIED MATHEMATICS (including **MECHANICS**), 4 hours per week.

SECOND TERM.

OPTICS.—Lectures: 2 hours per week.

MECHANICS.—Lectures: 2 hours per week.

OPTICS and MECHANICS.—Laboratory: 2 hours per week.

APPLIED MATHEMATICS.—2 hours per week.

THIRD TERM.

MECHANICS.—Lectures : 2 hours per week.

ELECTRICITY.—Lectures : 2 hours per week.

MECHANICS and ELECTRICITY.— Laboratory : 2 hours per week.

APPLIED MATHEMATICS.—2 hours per week.

FOURTH, FIFTH, AND SIXTH TERMS.

MECHANICS.—Lectures : 2 hours per week.

ELECTRICITY.—2 hours per week.

ELECTRICITY and MECHANICS.—Laboratory : 2 hours per week.

Chemistry.

Physical and chemical changes; distinction and phenomena attending them. Distinction between mixtures and compounds. Separation of constituents of mixtures. Fixity of proportion of constituents of compounds. Examples of synthesis and analysis of compounds. Elements. Constituents of air. Preparation and properties of oxygen. Combustion of carbon, sulphur, phosphorus, iron, magnesium, and sodium in oxygen. Acidic and basic oxides. Properties of nitrogen. Composition of air by volume. Constituents of water. Preparation and properties of hydrogen. Combustion of hydrogen and oxygen. Synthesis of water by burning hydrogen in air, and by the reduction of copper oxide. Decomposition of water by electrolysis and by passing steam over red-hot iron. Solutions of solids and gases in water. Water of crystallisation. Carbon. Allotropic modifications of carbon. Preparation and properties of carbon dioxide. Simple statement of the atomic and molecular theory of matter. The meaning of symbols, formulæ and equations, and their use as practical tools. Combustion. Explanation of the chemical action when a hydrocarbon burns. Products of complete combustion of hydrocarbons. Products of destructive distillation of coal. Structure of a flame. Calorific value of coal and oil. Slow combustion. Oxidation of metals; influence of moisture. Respiration. Spontaneous combustion of coal. Flash point of oils. Carbon as reducing agent. Incomplete combustion. Formation and properties of carbon monoxide. Producer gas. Sulphur. Properties of sulphur dioxide. Effects of pyrites in coal. Properties of ammonia. Acids, bases and salts. Preparation of salts by action of acids on metals, metallic oxides and hydroxides. Neutralisation. Double decomposition; precipitation. Valency of an element as an aid to prediction of formulæ. Examples of common classes of salts, namely :—Chlorides of sodium, silver and zinc, sal-ammoniac. Saltpetre. Gypsum and plaster of Paris. Lead sulphate. Washing soda and chalk. Preparation of lime from chalk. Cement. [Simple tests for these classes of salts.] Temporary and permanent hardness of water. Boiler deposits. Explosives. Essentials of a good explosive. Mixtures and compounds. Gunpowder. Meaning of explosion and detonation. Nitro-glycerine, gun-cotton, cordite and dynamite. Fulminate.

Optics.

Light travels in straight lines. Pin-hole camera. Shadows. Laws of reflection. Principle of sextant. Artificial horizon. Laws of refraction. Refractive index. Refraction through glass plate and prism. Atmospheric refraction. Total reflection; critical angle. Total reflection prism. Reflection at concave spherical surface. Parabolic reflector. Refraction through a lens. Meaning of focal length. Character and size of images formed by a lens. Geometrical construction of real and virtual images. Telescopes. Magnifying power. Erecting eye-piece. Range-finder.

PRACTICAL WORK IN OPTICS.

Laws of reflection. Laws of refraction. Refraction through plate and prism. Determination of refractive index of glass. Reflection at surface of concave mirror. Refraction through a convex lens. Magnifying power of a telescope. Range finder.

Mechanics.

(The items enclosed in square brackets are for the more able Cadets only.)

Fundamental mechanical ideas. Composition and resolution of forces, with illustrations. Conditions of equilibrium of three forces in one plane. Force polygon.

Moment of a force. Couples. Centre of gravity. Stresses in derricks, &c. [and in the parts of simple jointed frames loaded at the joints].

Work and energy. Conservation of energy.

Average, uniform, and variable speed; velocity at an instant; Newton's First Law of Motion; mass and inertia.

Effect of constant force on a body in direction of motion. Demonstration that, starting from rest, change of velocity is proportional to the time during which force acts, and that the velocity at any time is twice the average velocity from rest. Idea of uniform acceleration. Generalisation for all bodies moving under constant force. Deduction of $s = \frac{1}{2}at^2$. Vertical motion under gravity. For different forces on the same body, show that acceleration is proportional to force. Effect of force independent of velocity. Forces needed to produce the same acceleration in bodies of different masses. Kinetic unit of force; poundal and dyne. $F = ma$.

Comparison of masses of different materials. Distinction between mass and weight; weight proportional to mass. Relation between gravitational and absolute units of force.

Effect of constant force on a body in a direction inclined to the direction of motion. Composition and resolution of displacements and velocities. Projectiles. Horizontal projection. Effect of force independent of velocity of body, in all cases. Inclined projection; range on horizontal plane, neglecting air resistance.

Newton's Second Law of Motion. Physical independence of forces.

Energy. Proof that $Fs = \frac{1}{2}mr^2$ foot-poundals, and hence by law of conservation of energy, that $\frac{1}{2}mv^2$ measures kinetic energy. Graphic representation of work done by uniform and variable forces. Indicator diagrams. Power and horse-power. Transmission of power by belt. Brake horse-power. Rope and Prony brakes. Joule's equivalent.

Friction. Coefficient of friction between solids. Limiting angle of pressure at the surface of contact. Efficiency of power transmission in machines.

Stress. Every force is one aspect of a stress. Newton's Third Law of Motion. Momentum. Impact. Recoil. Conservation of momentum. Change of momentum measured by Ft. Reaction of Maxim gun, and of pipe delivering jet of water. Relative motion. Action of wind on sails, and of jet on turbine blades.

Velocity at an instant deduced from space-time curve. Velocity-time curve. Acceleration at any instant. To find acceleration from velocity-time curve. Value of a force at any instant given by $F = ma$. Composition of forces deduced from composition of accelerations. Vectors.

Uniform motion in a circle. Proof of expression for acceleration. Meaning of the term "centrifugal force"; conical pendulum, application to governors.

Kinetic energy of rotating body; moment of inertia; $T\theta = \frac{1}{2} I\omega^2$; function of flywheels; numerical examples.

Simple harmonic motion. Space-time curve a sine curve. Motion of a piston approximately S.H.M. [Acceleration in S.H.M. proportional to displacement; hence vibration in S.H.M. if restoring force is proportional to displacement. How to calculate the periodic time. Spiral spring, simple pendulum. Simple illustrations of vibration produced by periodic impulses.]

Hydrostatic pressure at a point. Total force on submerged plane surface. Idea of centre of pressure; [determination of centre of pressure in simple cases.] Centre of pressure of a rudder; torque on rudder head; balanced Rudders. Equilibrium and stability of floating body. Displacement tonnage; tons per inch immersion. Centre of buoyancy. Inclining experiments to investigate stability of ship. Metacentre and metacentric height. [Effect on stiffness and steadiness.]

MECHANICS.—(LABORATORY COURSE.)

Hooke's Law for a wire. Extension of wires to rupture, stress-strain curves. Torsion; to show angle of twist is proportional to the torque and also to the length. Measurement of co-efficient of friction. Measure value of a train of wheels, and efficiency of a machine. Application of triangle of forces and resolution of forces. Verification of calculated position of centre of gravity of a system of masses and of a lamina. Motion of a body from rest under constant force. Direct determination of an approximate value of "g." Comparison of the effects of different forces on

the same body. Path of a projectile, horizontal projection. Range of a projectile, inclined projection. Conversion of potential into kinetic energy. Measurement of brake horse-power and efficiency of a motor. Verification of principle of conservation of momentum. Measurement of reaction of a jet of water on the pipe. Verification of calculated value of centrifugal force. Kinetic energy of rotating flywheel. [Simple harmonic motion; to verify period of oscillation of a mass suspended from a spiral spring, and of liquid in a **U** tube. Period of oscillation of a simple pendulum.] Determination of centre of buoyancy, centre of gravity and metacentre of a ship model. [Construction of cam to fulfil given conditions.]

Electricity.

(The elementary phenomena of Magnetism and Current Electricity have been dealt with at Osborne. The items enclosed in square brackets are for the more able Cadets only.)

Practical units of current, resistance and E.M.F. Definition of ampère; standardising an ammeter by a copper voltmeter. Resistance of a wire and what it depends on. Ohm. E.M.F. and Difference of Potential. Volt. Standard cell. Use of high resistance galvanometer as voltmeter.

Ohm's Law. Verification for complete circuit and for any part of a circuit. Numerical examples. Effect of internal resistance of cell. Menotti testing set and its advantage for testing gun circuits.

Fall of potential along a uniform conductor. Potentiometer method of measuring E.M.F.

Resistances in parallel. Shunts. Weston Voltmeter and Ammeter.

Measurement of resistance by Wheatstone's Bridge. Measurement of resistance by observing potential difference when a known current is passing. Specific resistance. Effect of temperature on the resistance of metals and insulating materials. [Temperature coefficient.] Advantages of manganin, &c. Principle of Callendar's Thermometer. [Simple tests for insulation resistance. Tests for locating fault in a cable.]

Heating Effects. Joule's Law. Verification of $H = C^2 R t$. Watt. Board of Trade unit. Relation of Horse-Power to Watt. Hot wire voltmeter. Incandescent lamps. Electric power transmission. Efficiency of transmission; advantage of high voltage. [Elementary principle of thermo-electric junction and its use as a thermometer.] Arc lamps, hand and automatic. Search-lights.

Chemical effects. Secondary cells; behaviour during charge and discharge. Forms and actions of primary cells, Daniell and Leclanché.

Magnetic effects. Magnetic field due to a current. First notions of magnetisation of iron and steel by a solenoid, magnetisation curve. Force on a current-bearing conductor in a magnetic field. Suspended coil galvanometers. Electromotors; the functions and simple forms of armature, its iron core and multiple coils, commutator, brushes, field magnets, pole pieces, series and shunt windings.

Induction of currents. Dynamos; elementary notions.

Dual aspect of dynamo or motor; qualitative relations between mechanical work and current in dynamo and motor.

Types of winding of field magnets of motors and dynamos.

General behaviour of shunt and series wound motor (experimental).

General behaviour of shunt and compound wound dynamos.

[Characteristic curves of series and shunt dynamo and motor.] Conditions for exciting a dynamo.

Energy losses due to friction, electrical resistance of conductors, eddy currents in iron and copper, and hysteresis. Efficiencies of dynamo and motor.

Quantitative meaning of magnetic lines of force. [Absolute electromagnetic units of current, quantity, E.M.F. and resistance. Work done when a current-bearing conductor cuts across lines of force. Energy required to maintain a current. Value of E.M.F. induced by cutting lines of force. Energy required to establish a current; self-induction.] Forms of winding in ring and drum armatures. [Effect of varying impressed E.M.F. on a motor (1) when magnets are saturated, (2) when field strength varies with E.M.F.]

Armature reaction.

[Magnetic induction in iron. Measurement of flux; magnetising force; permeability; saturation; retentiveness.]

Hysteresis; energy loss in magnetisation. Molecular theory. Magnetic qualities of iron for various purposes.]

Electric bells; wiring for system; bell indicator. Telegraph; Morse sender and receiver; relay; earth return; method of wiring two stations to send and receive at each.

Telephone; receiver and transmitter.

Elementary ideas in electrostatics: charge, potential, capacity, induction, condensers, electrophorus, electrostatic voltmeter.

Induction coil. Spark. Wireless Telegraphy, brief outline.

ELECTRICITY.—(LABORATORY COURSE.)

Check ammeter by copper deposition. Verify Ohm's Law. Potentiometer, for measuring E.M.F. of a cell [and calibration of voltmeter and ammeter, and measurement of small resistance]. Measurement of resistances by Wheatstone's bridge method. Variation of resistance with dimensions of a wire; specific resistance. Measurement of resistance of an armature by ammeter and voltmeter. [Measurement of temperature coefficients.] Experiments with lamps in series and parallel. [Construct a practical voltmeter and ammeter out of a sensitive galvanometer and determine the value of the graduations. Simple loop test for locating a fault.] Use of cell-tester. Determination of Joule's equivalent. Connect up a shunt motor with starter, voltmeter and ammeter; reverse direction of rotation; determine power taken when running light; run it on a brake and compare brake horse-power with electrical in-put. [Compare back E.M.F. of a motor as calculated from total armature resistance and current in armature, with the E.M.F. generated in the same armature when run as a dynamo in the same direction at the same speed and with the same excitation of field magnets. Plot speed of shunt motor against field current, when running light.] Experiments on a shunt dynamo; illustration of failure to excite, and how corrected; regulation of voltage; determination of efficiency. Determination, by separately excited dynamo, of relation between voltage, field current, and speed. Sketch all connections of switch-board and motor generator, including starting resistance, field regulators [and automatic cut-outs]. Practise starting and controlling motor and dynamo, and charging battery. [Take external characteristics of shunt dynamo, and determine from it the total characteristic; same experiment with series dynamo.] Experiment on arc lamp. [Magnetisation curves of iron and steel. Measure insulation resistance with megger.] Assemble the units of two telegraph stations.

Text Book.—Electricity and Magnetism, Ashford (Arnold).

English Language and Literature.

FIRST TERM.

Exercises in the use of words, synonyms and figures of speech. Instruction in the analysis and in the construction of sentences. Paraphrasing and reproduction. Lessons in the method of expanding disconnected detail into continuous prose.

Reading aloud in class of fairly long selections from easy and picturesque prose-authors such as Prescott, Napier, Macaulay; and of easy selections from poets such as Goldsmith, Tennyson. For this and all terms a number of authors is allotted sufficient to allow of considerable choice.

Repetition: A minimum of 70 lines of English Poetry (taken from Cookson's "Selections from English Poetry"). In each term the cadets are allowed a certain liberty in the choice of pieces to be committed to memory.

SECOND TERM.

Paraphrasing of more difficult pieces. Reproduction of longer and more difficult passages. Exercises intended to develop faculties of observation and description. Instruction in letter-writing (personal).

Reading aloud in class of passages from prose-authors such as Southey, Thackeray, Addison. Reading selections from Arnold and Coleridge, and also two of the easier plays of Shakespeare, one a comedy and one an historical play.

Repetition: Revision of First Term's lines, with 70 additional lines.

THIRD TERM.

Continuation of the work of the Second Term at an advanced standard. Lessons in paragraph-building. Letter writing (personal) continued.

Reading aloud of prose passages from authors such as Goldsmith, Addison, Kinglake; two essays of Macaulay; poetry from different authors and also two further plays of Shakespeare, a comedy and an historical play.

Repetition: Revision of previous work, with 70 additional lines.

FOURTH TERM.

Continuation of the work of previous terms. Lessons in the making of abstracts and summaries of simple passages. Expansions of more difficult passages. Letter-writing (personal and official).

Reading aloud of prose passages from Boswell, Carlyle and Froude; two more essays of Macaulay; two of Shakespeare's historical plays.

Repetition: Revision of previous work, with 70 additional lines.

FIFTH TERM.

Longer and more difficult Abstracts or Summaries. Exercises in literary taste in the form of criticism of selected passages of prose and poetry. Letter-writing carried on. Easy Constructive Essays.

Reading aloud from Gibbon, Lamb, and Emerson; two more of Macaulay's essays; in poetry Byron's "Childe Harold," and a tragedy and a comedy of Shakespeare.

Repetition: Revision of previous work, with 70 additional lines.

SIXTH TERM.

Work in composition continued on the same lines, but on an advanced standard. Further exercises in carefully chosen essay subjects.

Reading aloud of selections from Bacon, Burke, and Walpole's Letters; a literary essay of Macaulay and the Third Chapter of Macaulay's History; in poetry, a tragedy and a comedy of Shakespeare.

Repetition: Revision of previous work, with 70 additional lines.

European History.

FIRST TERM.

Beginning of the Renaissance; invention of printing; age of discovery and founding of Empires. The great Powers of Europe and their relations at the opening of the 16th century. Germany before the Reformation. The Protestant revolution in England, France, Germany, and elsewhere. The Counter Reformation. The Thirty Years' War.

SECOND TERM.

Richelieu and the establishment of absolute monarchy. The struggle for Parliamentary freedom in England. The ascendancy of France in the reign of Louis XIV. The rise of Russia and Prussia. The expansion of England.

THIRD TERM.

The evils and abuses of the Old Régime in France. Louis XIV, and attempts at reform. Destruction of the Old Régime. Attempts to make a constitution between 1789 and 1791. First French Republic and the war against Europe, 1792-3. Reign of Terror. France in 1795. Bonaparte in Italy and Egypt. Bonaparte as Consul. Napoleonic Empire. Napoleon's Campaigns. National uprisings against him, and his downfall.

FOURTH TERM.

Congress of Vienna. France under restored monarchy and the Second Republic. Napoleon III. The Third Republic. The unification of Italy. The struggle for liberty and unity in Germany. Foundation of the German Empire under Bismarck and William I. The Turkish question.

FIFTH TERM.

The United Kingdom and the Empire since Waterloo; relations with Europe and other powers during the century; industrial revolution; Catholic emancipation; abolition of slavery; Reform Bills and widening of the Franchise. Irish question; social and economic changes; democracy and socialism. Growth of the great self-governing colonies of Canada, Australia, and South Africa. British rule in India and Egypt. Imperialism: comparison of British and other great colonial empires.

SIXTH TERM.

For the first half of the Term:—European and international situation at the present day; new and coming Powers, *e.g.*, Japan, Argentina, Brazil, and China; Monroe Doctrine and Panama Canal; white and yellow in the Pacific; the struggle for markets.

For the second half of the Term:—Revision and generalisation.

Text Books:—History of Western Europe, J. H. Robinson (Ginn); England in the Nineteenth Century, C. W. C. Oman (Arnold); Gardiner's School Atlas of English History; Atlas of Outline Maps.

Naval History.

The history of the Navy from the Commonwealth to the end of the Revolutionary wars:—

TERM 1.

Beginning of the Commonwealth to the Peace of Ryswick.

The Navy of the Commonwealth; its constitution as compared with the preceding organisation; the ship of the period; the Navy establishes the position of the Commonwealth and ensures its respect abroad. Causes of first Dutch War; the war itself; aims of the combatants.

The Restoration; Tangier, its acquisition, use, and abandonment. Second and Third Dutch Wars. The Revolution of 1688; the Irish War; Beachy Head; attempt at invasion; La Hogue and the Peace of Ryswick.

TERM 2.

Peace of Ryswick to the Peace of Paris (1763). War of the Spanish Succession; Peace of Utrecht.

Spanish discontent with the Peace; the war of 1718-20; attempted invasion. Difficulties in 1727; War in 1739. The Intervention of France. The War of the Austrian Succession. The use of the Mediterranean Squadron. Attempted invasion of 1744. The Western Squadron under Anson and Hawke. Peace of Aix-la-Chapelle. How Europe, America, and India were left by that peace. Outbreak of War with France and its Causes. The War with France merges into the Seven Years' War; attempted invasion of 1759; particular reference to the method of direction of the War.

Events in East Indies during both these wars to be touched upon, but not made a main feature.

TERM 3.

From end of Seven Years' War to the end of War of American Independence.

Choiseul's plans for Invasion; regeneration of the French Fleet. The War of American Independence; general military features of the war before the French intervention in 1778; Howe; position in Channel leading up to Keppel's action; opening of fighting in India; also in the West Indies. Why Gibraltar was besieged. Spanish Intervention in 1779. Kempenfeldt's management of home defence. Rodney's relief of Gibraltar. Holland joins allies against England, making a three-Power coalition. Rodney in the West Indies. Importance of Cornwallis's surrender; account for that event; Hood; Howe's campaign in 1782; Darby's relief of Gibraltar. Siege of Minorca. The Dogger Bank. Fleets of France and Spain in the Channel. Hood and Rodney and De Grasse. Events in East Indies again to be referred to, but not as a main feature of the War.

TERM 4.

Beginning of Revolutionary Wars to the Peace of Amiens (1802).

Improvement in the Navy. Hood and Howe's evolutionary cruises. England's reason for War with France; events leading up to the Battle of the First of June. Military and Political Events and Alliances. Toulon; reasons for presence of the British squadron in the Mediterranean. Hothams indecisive action and its result;

Nelson's activity on the coast in co-operation with the Austrians; Jervis; Mediterranean abandoned and re-entered. The Nile Campaign; Malta; St. Vincent in command of the Channel; blockade of Brest. The Armed Neutrality; Copenhagen; the Peace of Amiens.

TERM 5.

Renewal of War in 1803 to 1815.

St. Vincent's Work at the Admiralty. Preparations for invasion; British measures for defence. Spain joins France. Trafalgar Campaign. Events after Trafalgar. The Continental System. General directions of the War till 1815. American War of 1812.

TERM 6.

Recapitulation, laying stress on the naval operations which best emphasize the threads that run through the History and the influence of the Navy on the European and Imperial Position.

Text Book.—Sea Kings of Britain, Callender (Longmans).

Modern Languages.

a. The following applies to Cadets who will pass out from Dartmouth in or before July 1912:—

These Cadets learnt only French at Osborne; during their two years at Dartmouth the better linguists amongst them, to the number roughly of half of each term, divide their time (four hours teaching and two hours preparation a week) equally between French and German. The remainder continue to confine their attention to French.

The French is intended in all cases to be colloquial, modern and literary. Cadets are trained to acquire a general vocabulary in writing and speaking. The books they read are chosen chiefly from 19th century authors.

Those who learn German come to Dartmouth with no knowledge of the language; they do not, in the two years there, learn to speak it, but aim rather at being able to read with comparative ease a modern German author, such, for example, as Widenbruch or Mörike. They get sufficient practice in composition to make it worth while to continue it later.

b. The following applies to Cadets who will pass out in or after December 1912:—

These are divided on entry at Osborne into two groups, roughly equal in number and linguistic capacity; one of these henceforth devotes itself solely to French, the other to German. The Cadets who join at Dartmouth from the "Conway" are included in the former group.

Under this system, whether the Cadet learns French or German, the aim is identical. It is expected that Cadets will be able to converse fairly fluently with a foreigner, or to write a letter in the foreign tongue, and that they will have laid a sound foundation for acquiring the power to read foreign books useful in their career.

The following books are in use in 1912 for modern languages, but the text-books are frequently changed:—

Dictionaries.—Bellow's Pocket French Dictionary (for use at sea) (Longmans).

Gazier's French Dictionary (Colin). James' German Dictionary (Tauchnitz).

Grammars.—Spiers' Exercises in French Grammar. Somerville and Byrne's German Grammer (Rivington).

Authors.—*French.*—Pierre Loti, *Les Pêcheurs d'Islande* (Rivington); E. About, *Le Roi des Montagnes* (Hachette); Dumas, *Les trois Mousquetaires* (Ginn); A. Daudet, *Contes du Lundi* (Charpentier); *Lettres de mon Moulin* (Nelson), *Tartarin de Tarascon* (Flammarion); Victor Hugo, *Les Misérables*, *Quatrevingt-treize* (Ginn); *La Fontaine*, *Fables* (Blackie); Molière, *Le Médecin malgré lui*.

German—Lehmensick, *Thüringer Sagen*; Hauff, *Märchen* (Reckun); Klee, *Heldensagen*; Gerstäcker, *Herrn Mahlhuber's Reiseabenteuer*; Schiller, *Wilhelm Tell* (Cotta, Stuttgart), *Historische Skizzen* (Clarendon Press); Storm, *Immensee* (Ginn); Rosegger, *Die Försterbuben*; Widenbruch, *Lachendes Land* (Grotesche Verlagsbuchhandlung, Berlin).

For Repetition Cadets learn La Fontaine or some German ballads printed at the College for this purpose.

Religious Instruction.

Term.	New Testament.	Old Testament, &c.
First	St. Matthew and St. Mark, with special reference to the Miracles. Prayer Book I.	2 Samuel I.—1 Kings IX. Repetition, Job XXXVIII.
Second	St. Matthew and St. Mark, with special reference to the Miracles. Prayer Book II.	1 Kings X.—2 Kings X. Repetition, Psalms LI. and CXXI.
Third	St. Paul's Epistles. Prayer Book III.	2 Kings XI.—Captivity. Repetition, Psalm XV., and Ecclesiastes XI. and XII.
Fourth	St. Luke, with special reference to the Parables.	Revision of Period up to Division of the Kingdom. Repetition, Isaiah XI. and LV.
Fifth	St. John, with special reference to the trial and death of Our Lord.	General History of Christianity. Repetition, St. John XIV. and XV.
Sixth	General review of Our Lord's Ministry, and of the Acts.	General classification of Books of the Old and New Testament, with History of the Canon. Repetition, I Corinthians XV.

LECTURES ON THE HISTORY OF CHRISTIANITY.

FOUR MAIN DIVISIONS:—

- A.—*The Beginning.*
- B.—*The Middle Ages.*
- C.—*The Reformation.*
- D.—*The Church since the Reformation.*

A.—*The Beginning.*

Lectures I. and II. The foundation of the Church; struggle for existence; persecutions; final victory.

Additional Topic: The Hermits.

Lecture III. The organisation of the Early Christian Churches; difficulties meeting the Church and causing dissensions; Arius; chief points at issue between the Eastern and the Western Church; rise of Monasticism.

Lecture IV. The growth of the power of the Roman See and the reasons accounting for it; its vigour in the mission field; conversion of England; victory of Roman over Celtic Christianity.

B.—*The Middle Ages.*

Lecture V. The reform of Monasticism; the investiture quarrel; the Crusades and chivalry; increase of Papal power.

Additional Topic: The Friars.

Lecture VI. The period of Papal supremacy; abuses of the Church; Babylonian exile; great schism; Council of Constance; growing independence of national Churches.

Additional Topic: Wycliffe, Huss.

C.—*The Reformation.*

Lecture VII. Luther and the Protestant Reformation; Calvin and the Reformed Church; the English Reformation.

Lecture VIII. The Catholic Reformation; work of the Society of Jesus; Council of Trent; Inquisition.

D.—*The Church since the Reformation.*

Lecture IX. The Romantic Movement—its influence on the Church; the Oxford Movement; the different parties in the Anglican Church.

Lecture X. The position of the Modern Pope; his attitude to the Powers, especially Italy; points at issue between Modern Roman Catholicism and Modern Protestantism; Papal Infallibility.

Lecture XI. The Church and Society at the present time; relation of the Church to politics and social problems; Church hampered by her own divisions; hopes of reunion.

Engineering.

First Term: 18 Lectures.

Recapitulation of Slide Valves and Indicator Diagrams.

Elementary Theory of Turbines. Flow of Steam. Details of Construction. Reversing Turbines. Cruising Turbines. Turbine Losses.

Recapitulation of Energy. Formation of Steam at Constant Pressure and Volume. Liquefaction of Steam and Cooling of Gases by work done during expansion. Recapitulation of effect of Liquefaction in Reciprocating Engines and of Cylinder Condensation Loss, and means of reducing it. Effect of Liquefaction in Turbines. Wire Drawing and its drying effect.

Workshop Lectures on Tools and Gearing. Machine and Quick Return Motions. Forge Work. Plate Work. Tank Boiler Construction. Testing Machine.

Second Term: 18 Lectures.

Combustion. Spontaneous Combustion. Calorific Value. Evaporative Power. Composition. Combustion of Coal in a Furnace. Losses. Funnel Draught. Forced Draught.

Oil Fuel. Fractional Distillation. Composition. Cracking, Flash, and Ignition Point. Oil Fuel Burners and Installation. Losses. Comparative advantages of Coal and Oil Fuel.

Boilers:—Details and Construction of various types; comparative advantages of Water Tank and Water Tube.

Workshop Lectures on adjustments, Opening Out, Examinations, Clearances and Gauges of large Engines, Reading and adjusting Slide Valves from Battens, Pattern Making and Moulding.

Third Term: 18 Lectures.

The Internal Combustion Engine. Water Jacketing. Silencer. Ignition. Compression. Regulation of Speed and Power. Oil Engines. The Hornsby-Akroyd Engine. The Diesel Engine.

Gas Producers. Vaporisers. Explosive Mixtures. Ignition. Scavenging Charge of Air. Two-stroke Cycle. Indicator Diagrams of internal combustion Engines. Relative advantages of Reciprocating Steam Engines and Steam Turbines; Gas Engines and Oil Engines; Water-Tube and Cylindrical Boilers; Coal and Oil Fuel. Properties of Metals. Tempering and Hardening. Copper and its alloys.

Workshop Lectures on alignment of Bearings, Condenser Work, Propellers—Shape and Pitch. Examination, Testing, Cleaning and Repair of Boilers.

Fourth Term: 16 Lectures.

Transmission of Power. Hydraulic Principles. Hydraulic Pressure Pump Types of Rams. Hydraulic Engines and Appliances. Reversing and Slide Valves. Regulation of Pressure. Advantages of Hydraulic Transmission. Recoil Presses. Air Compressors. Compressed Air Engines. Cold Air Refrigerators. Expansion Valve. Vapour Refrigerators. Recapitulation of D. Slide Valve and Piston Valve. Relative positions of Piston and Slide Valve.

Workshop Lectures on Boring Bars, Marking Off, Molding and Pattern Making.

Fifth Term: 15 Lectures.

Linking up and Throttling of Steam Engines. Adjustment of Work in Cylinders of Stage Expansion Engines. Faults of Indicator Diagrams. Differential Valve. Reversing Engines. Turning Engine. Boat Hoist Engine. Capstan Engine. Steering and Controlling Gear. Tiller Gear. Relief Valves. Reducing Valves. Methods of Balancing Pressure. Governors. Hunting and Adjustments. Automatic Feeds. Losses of Fresh Water on board ship. Drain System and Steam Traps. Evaporators, Distillers, Density, Filter, Feed and Lime Tanks. Tests for Fresh Water. Lubrication and Wear of Bearing Surfaces.

Workshop Lectures on Fits, Gauges, Machine Tools and Accessories. Jointing and packing. Electrical Work.

Sixth Term. 15 Lectures.

Ship resistances. Propulsion, Propellers, form and detail of. Cube Rule. Curves of Performance (Power, Speed, Consumption). Efficiencies of Engines and Boilers.

Workshop Lectures on Electrical Work. Coppersmithing. Gear Cutting, Milling. Also, whilst in the Drawing Office, Lectures on Elementary Calculations of the Strength of Simple Forms in Tension, Compression, Shearing.

Text-books.—Modern Steam Engine, Oram and Sennett (Longmans); Engineering Note-books, 2 vols.

SYLLABUS OF LECTURES.

The more able cadets take the whole syllabus. As much of it is taken by the others as is found practicable.

WORKSHOP CYCLE.*

Term.	First.	Second.	Third.	Fourth.	Fifth.	Sixth.
Part -	A B C D	A B C D	A B C D	A B C D	A B C D	A B C D
First Half of Term	Q Q M M	P F M M	Q Q M M	F P M M	O N M M	N O M M
Second Half of Term	M M Q Q	M M P F	M M Q Q	M M F P	M M O N	M M N O

M = Machine Shop.

P = Pattern Shop.

N = Coppersmiths' Shop.

Q = Boiler Shop.

F = Foundry.

O = Drawing Office.

* The cadets of each term are divided into four groups, A, B, C, D, for instruction in Engineering as at Osborne.

PRACTICAL WORK.

FIRST TERM.

Machine Shop, 6 weeks:—

Steamboat instruction (one week).

Testing room—Tension, torsion and shearing tests of various metals and materials. Plotting curves (one week).

Machines—One day on each of following machines: small shaping, slotting and planing. Elementary marking off.

Small lathes—Work such as spindles, flanges, screw-cutting, piston rings with allowance, boring and facing small brasses.

Bench work—Fitting small brasses, eccentrics, &c., renewing water gauge glasses. As a test job—Fitting turbine blade stop.

Boiler Shop, 6 weeks:—

Forge work—Welding, dress and temper chisels and tools. Small forgings. Use of steam and pneumatic hammer.

Working light plating, such as building tanks, funnels, buckets. Marking off, straightening and levelling plates, shearing and punching, light flanging, erecting and riveting.

Working up corners (hot), joggling, shaping angle irons.

Heavy riveting and caulking; drawing, annealing, replacing, expanding and ferruling boiler tubes. General explanation of boilers in workshops, pointing out special features.

SECOND TERM.

Pattern Shop, 6 weeks:—

Small simple work, making the necessary allowances for draw, shrinkage and machining.

Making pattern of ring or wheel in segments. Any surplus time to be employed in general work.

Patterns from drawings involving cores, loose pieces and fillets.

The course to conclude with explanations of construction of typical stock patterns.

Machine Shop, 6 weeks:—

Power house—Recapitulation of indicator diagram. Practice in taking diagrams of steam and oil engines. Calculations of mean pressure and horse-power. Difference between theoretical and actual diagram. General explanation of turbine and oil engine.

Main engines :—

- (1) Open out cylinder, remove piston, take clearances, replace piston and close up cylinder.
- (2) Remove and replace metallic packing. Relit white-metal segments.
- (3) Adjust main crank head bearings. Taking leads.
- (4) Open out, examine and re-set slide valve, using battens.

Machines—One day on each of following machines: shaping, slotting, milling and planing.

Large lathes—Work such as connecting rods, piston rods, flanges, piston rings, facing and boring brasses.

Bench—General fitting and blading work. Test pressure gauges

THIRD TERM.

Machine Shop, 6 weeks :—

H.M.S. "Pomone" (one week). General inspection of Department. Tracing run of more important pipes and fittings, priming and topping fires. Finishing tracing pipes and fittings, and make line sketch of auxiliary steam and exhaust pipes. Precautions taken before lighting up. Raising steam. Warming through and working main engines. Motor boat.

Small lathes—Crank shafts and general work such as stop valves, plugs and shells for straight-way cocks. Large shaping and boring machines, milling machines.

Bench work—Re-tubing and testing condenser, aligning bearings and pulleys. Taking pitch and area of propeller blade.

Boiler Shop, 6 weeks :—

Forge work—Forging connecting rods, eccentric rods, &c. Making and tempering spiral springs. Case hardening. As a test job—Weld an iron bar.

Patching, re-fitting zinc slabs, drill testing.

Water pressure test and use of deflection meter. Making joints of boiler doors. Bend tubes to gauge.

Bend to shape, fit, expand and bell-mouth tube in water-tube boiler.

Drawing—Making sketches of plate-work of boilers, of tube joints, stays, and sections of details.

FOURTH TERM.

Foundry and Testing Room, 6 weeks :—

General moulding, including open moulds, loam moulds, moulds involving false cores, three boxes, loose pieces, drawbacks, and cores of sand and loam.

Burning on and making moulds from part patterns. Casting in iron and brass.

Testing room: torsional tests of solid and hollow specimens: plotting curves.

Machine Shop, 6 weeks :—

H.M.S. "Pomone" (one week). Oil-engine boat. Trace pipes of closed exhaust system and evaporating plant and make sketches. Working main engines, taking diagrams, varying cut-off, and with and without closed exhaust. Raise steam from separate stokeholds, connecting up to separate engine rooms. Work main engines as far as possible without assistance.

Open out, examine, and make sketches of Weir's pump, hydraulic jack and torpedo.

Bench and machine work. Erecting engines. Marking off.

Large lathes—Use of boring bar and boring generally.

FIFTH TERM.

Drawing Office, 6 weeks :—

Lecture on Stress and Strain. Calculation of stresses under tensile, compressive and shearing loads. Factor of safety, bearing pressures. Making fair drawing from rough sketch of main engine details. Calculation of factor of safety of parts of same.

Machine Shop, 6 weeks :—

Torpedo boat (one week). Trace pipes in engine-room and stokehold. Raise steam at moorings. Steam at 15 knots, keeping watch in engine-room and stokehold. Sketching pipe leads.

Open out, examine and make sketches of air compressor, refrigerator and gun mounting. Make leather.

Bench and machine work. Erecting engines. Use of Morse re-seating tool.

Electrical work—Making a circuit containing lamps in parallel and in series, with cut-outs and switches. Making joints of lead-covered wires. Winding and insulating solenoids and induction coils.

Testing magnet windings for faults. Fitting brushes. Tracing circuits in power-house.

SIXTH TERM.

Coppersmith's Shop, 6 weeks:—

Make and braze collar to small pipe for union joint.

Make "bit" joint and plumber's joint in small lead piping.

Socket and braze pipe about $2\frac{1}{2}$ " diameter.

Braze branch on $2\frac{1}{2}$ " pipe, making saddle junction. Braze on flanges and test pipe.

Make tin paint kettle.

Machine Shop, 6 weeks:—

Torpedo boat destroyer (one week). Trace pipes in engine room and stokehold. Sketch steering gear. Steam at 15 knots, keeping watch in stokehold and engine rooms. Raise steam and move engines at moorings.

Power House (one week). Working auxiliary engines. Coal and water consumption. Trials and calculations of efficiencies.

Bench and machine work. Erecting engines. Use of gear-cutting machines.

Electrical work. Building up armature cores and commutators. Making ferro-wound armature coils. Winding armature and making end connections. Testing armature winding for faults. Examination of dynamos and switchboard.

<i>Seamanship.</i>	No. of Hours.
<i>Bends and Hitches.</i> —To know the use of, and to be able to make the bends and hitches mentioned on page 66, Manual of Seamanship, 1908.	3
<i>Knots.</i> —To know the use of, and to be able to make, wall, wall and crown, Double Matthew Walker, Standing Turk's Head.	2
<i>Splices.</i> —To know the use of, and to be able to make, short splice, long splice, and eye splice.	3
<i>Rigging.</i> —To know the names of all yards and masts. A good knowledge of the rigging and fitting of modern masts and yards.	5
<i>Rule of the Road.</i> —To be taught as laid down in "Regulations for Preventing Collisions at Sea" (Dec. 1910), omitting Article 9, and Regulation 1036. Too much detail as to height of lamps, &c. is to be avoided.	7
<i>Boats.</i> —Pulling and steering. General knowledge under oars. Handling a boat under oars. Making and shortening sail. Names of all parts and fittings of a cutter and pinnace.	30
Management of boats under sail, and knowledge of various duties of crew.	
Hoisting and lowering boats.	
Securing boats for sea.	
Use of boat rope.	
<i>Anchors and Cables.</i> —To be able to point out, to name, and to know the use of, as mentioned in Chapter 8 of Manual of Seamanship, 1908, omitting the following:—Cat chain, Warping, Kedging.	10
To be able to let go, weigh and eat an anchor; to understand the object of mooring; to have a good knowledge of how to rig hand capstan.	
<i>Compass.</i> —A thorough knowledge of the compass in degrees, and to be able to box in quarter points. To be able to steer and alter course.	8
<i>Sails.</i> —Names of sails of square-rigged ships. Names and parts of boat's sails, how bent, and made up.	4

Seamanship -continued.	No. of Hours.
Tackles.—To be able to describe, and to know the use of and power gained by	5
Single whip.	Luff.
Double whip.	Tail jigger.
Runner and tackle.	Three fold purchase.
Runner.	
Log and Lead.—General knowledge of, and know how to use:—	4
Cherub patent log.	
Hand lead line.	
Boat's lead line.	
Kelvin's sounding machine.	
Lifeboat and Derricks.—A general knowledge of how to slip a lifeboat, what is stowed in her, &c. How to hoist in and out boats with main derrick.	5
	Total - 86

SIGNS.

1st Term. 7 hours.	Making and taking in Semaphore and Morse.
2nd Term. 7 hours.	Making and taking in Semaphore and Morse.
3rd Term. 7 hours.	Making and taking in Semaphore and Morse, with special signs.
4th Term. 5 or 7 hours.	Making and taking in Semaphore and Morse with special signs, with 2 or 3 hours at colours of flags and substitutes, and pendants.
5th Term. 5 or 7 hours.	Making and taking in Semaphore and Morse with special signs, with 2 or 3 hours at colours of flags and substitutes and principal foreign ensigns, and pendants.
6th Term. 5 or 7 hours.	Making and taking in Semaphore and Morse with special signs, with 2 or 3 hours at flags and principal foreign ensigns and special pendants.

			Number of Hours.	Semaphore.	Morse.	Flags.
1st Term—Christmas	-	-	7	3 $\frac{1}{2}$	3 $\frac{1}{2}$	—
2nd Term—Easter	-	-	7	3 $\frac{1}{2}$	3 $\frac{1}{2}$	—
3rd Term—Summer	-	-	7	3 $\frac{1}{2}$	3 $\frac{1}{2}$	—
4th Term—Christmas	-	-	7	2	2	3
5th Term—Easter	-	-	7	2	2	3
6th Term—Summer	-	-	5	1 $\frac{1}{2}$	1 $\frac{1}{2}$	2
			40	16	16	8
1st Term—Summer	-	-	7	3 $\frac{1}{2}$	3 $\frac{1}{2}$	—
2nd Term—Christmas	-	-	7	3 $\frac{1}{2}$	3 $\frac{1}{2}$	—
3rd Term—Easter	-	-	7	3 $\frac{1}{2}$	3 $\frac{1}{2}$	—
4th Term—Summer	-	-	5	1 $\frac{1}{2}$	1 $\frac{1}{2}$	2
5th Term—Christmas	-	-	7	2	2	3
6th Term—Easter	-	-	7	2	2	3
			40	16	16	8
1st Term—Easter	-	-	7	3 $\frac{1}{2}$	3 $\frac{1}{2}$	—
2nd Term—Summer	-	-	7	3 $\frac{1}{2}$	3 $\frac{1}{2}$	—
3rd Term—Christmas	-	-	7	3 $\frac{1}{2}$	3 $\frac{1}{2}$	—
4th Term—Easter	-	-	7	2	2	3
5th Term—Summer	-	-	5	1 $\frac{1}{2}$	1 $\frac{1}{2}$	2
6th Term—Christmas	-	-	7	2	2	3
			40	16	16	8

Text-books.—Seamanship Manual, Vol. I.; Regulations for preventing collisions at sea.

III.



Enclosure No. 11 in Third Report of Education Committee, dated 13th September 1912.

TABLE showing the TIME allotted to the VARIOUS SUBJECTS, ROYAL NAVAL COLLEGE,
DARTMOUTH, 15th July 1912.

Hours Weekly.

Total, 43½ hours a week.

* For those Cadets who can reach the Standard in Navigation in a shorter time, time is transferred to Mathematics up to the following maximum:—One hour Instruction and half-hour Preparation in Fourth Term, one hour Instruction and one hour Preparation in Fifth Term, two hours Instruction and one hour Preparation in Sixth Term.

Enclosure No. 12 in *Third Report of Education Committee*, dated 13th September 1912.

PROPOSED RE-ARRANGEMENT of the TIME given to CERTAIN SUBJECTS at the ROYAL
NAVAL COLLEGE, DARTMOUTH.

Weekly Hours (Teaching + Preparation):

	First Term.	Second Term.	Third Term.	Fourth Term.	Fifth Term.	Sixth Term.	Aggregate Number of Hours.	Aggregate hitherto.
<i>Top Class.</i>								
Mathematics	-	-	9 ³ ₁	7	5 ³ ₄	5 ³ ₄	1 ¹ ₂	447
Navigation	-	-	-	1 ³ ₄	2 ¹ ₂	3 ³ ₄	1 ¹ ₂	210
Charts	-	-	1 ¹ ₄	-	1 ¹ ₄	1 ¹ ₄	1 ¹ ₂	57
Statics	-	-	2	2	2	-	-	39
Dynamics	-	-	-	2 ¹ ₄	3	2 ³ ₄	2 ³ ₄	165
Electricity	-	-	-	1 ¹ ₂	1 ¹ ₂	2 ¹ ₂	2 ¹ ₂	126
<i>Bottom Class.</i>								
Mathematics	-	-	9 ³ ₁	7	5 ³ ₄	5 ³ ₄	-	339
Navigation	-	-	-	1 ³ ₄	2 ¹ ₂	3 ³ ₄	9 ¹ ₄	312
Charts	-	-	1 ¹ ₄	-	1 ¹ ₄	1 ¹ ₄	1 ¹ ₂	57
Statics	-	-	2	2	2	-	-	39
Dynamics	-	-	-	2 ¹ ₄	3	3	3	171
Electricity	-	-	-	1 ¹ ₂	1 ¹ ₂	2 ¹ ₂	2 ¹ ₂	132

Includes Spherical Trigonometry.

Enclosure No. 13 in Third Report of Education Committee, dated 13th September 1912.

SIR,

Admiralty,

11th August 1912.

My Lords Commissioners of the Admiralty, having had before them the second report of the Committee appointed to inquire into the education and training of Naval Officers, desire me to inform you that they have been pleased to approve of the Committee's recommendations, and that they have caused the necessary instructions to be issued accordingly.

2. I am to request that a copy of the evidence furnished to the Committee may be forwarded in due course for Their Lordships' information.

I am, Sir,

Your obedient Servant,

Admiral Sir Reginald N. Custance,
K.C.B., K.C.M.G., C.V.O.,
Admiralty.

W. GRAHAM GREENE.

Enclosure No. 14 in Third Report of Education Committee, dated 13th September 1912.

TRAINING AND EXAMINATION OF JUNIOR OFFICERS UNDER THE NEW SCHEME.

Circular Letter.

No. 51.
N. 2500 1908.

Admiralty, S.W.,
1st May 1908.

My Lords are of opinion that the time has now arrived to define clearly the principles, and lay down the routine of the instruction of Midshipmen under the new scheme during their three years' service at sea, and to issue a statement of the general lines of the examination which they will have to pass at the expiration of that period to qualify them for advancement to the rank of Sub-Lieutenant, and subsequently to that of Lieutenant.

My Lords have decided that while the training must be such as will ensure that the Officers as a whole will have a sufficient knowledge of all the duties which they will be called upon to undertake in the capacity of Sub-Lieutenant and Lieutenant, it must at the same time afford facilities for the higher education of such portion of them as will afterwards be required to specialise in Gunnery, Torpedo, Engineering and Navigation.

With this object in view, the Midshipmen after leaving the Training Cruisers will serve for three years at sea, at the end of which time they will pass their examination for Lieutenant. They will then be required to serve for another two years at sea as Sub-Lieutenant and Lieutenant, the length of time in each rank being dependent on the Classes they take in their examination. After this period, namely five years spent continuously at sea, a certain portion of them will be selected to specialise in the various Branches.

The present system of compulsory school for Midshipmen will be abolished, and the training of Junior Officers during their three years at sea in the rank of Midshipmen will be carried out wholly on professional lines designed to enable them to obtain a thoroughly practical knowledge of their profession. In the interest, however, of individual Officers, and particularly of those who will specialise later, facilities will be afforded for the voluntary study of Mathematics, Science, Naval History and Languages, which will enhance the prospects of earlier promotion to the rank of Lieutenant for those who voluntarily pursue such studies.

The Regulations governing the examination for the rank of Lieutenant have been framed so that those Officers will duly qualify who confine themselves to the practical side of their professional work, while they offer special advantages to those who also take up the theoretical side. My Lords attach the greatest importance to the experience which should be gained by these young Officers from the time they are transferred to the active Service as Midshipmen until they are eligible to specialise, and they regard it as essential for the success of the scheme that this period should be passed continuously at sea.

The Midshipmen under the new scheme will have received a thorough education in school subjects as well as a grounding in the elements of their profession during the four years and eight months passed in the Colleges and on board the Training Cruisers: and the proposed scheme of training afloat should provide sufficiently for their obtaining a thorough knowledge of the practical work of their profession and avoid the necessity for the present Courses in Gunnery, Torpedo and Pilotage prior to the examination in those subjects for the rank of Lieutenant. These Courses will therefore be abolished.

It has been decided until further experience is gained to appoint Naval Instructors to Ships carrying the new scheme Midshipmen, and their duties generally will be as follows:—

- (a) To superintend the observations and the working out of the Ship's position every day at sea by those Midshipmen who are not attached to the Navigating Officer:
- (b) To assist the Specialist Officers with the theoretical instruction of the Midshipmen in the various professional subjects:
- (c) To encourage voluntary study and to help the Midshipmen who wish to keep up and improve their educational acquirements:
- (d) To assist any Commissioned Officers who desire to work up for specialisation.

Details of the scheme of training and examination are given below. The Appendix which contains the syllabus of each of the subjects for examination is issued merely as a guide in respect to the instructional studies of Midshipmen. It is to be understood that the details are subject to revision as experience may show to be necessary.

An annual examination of Junior Officers afloat will continue to be held which will include papers on all the subjects in the compulsory parts of the examination for Lieutenant. The papers will be sent out from the Admiralty.

TRAINING.

On leaving the Training Cruiser the Cadets will be rated Midshipmen with seniority of the 15th January, 15th May, and 15th September, according to the time of passing out, and they will be appointed to Ships in such proportions as may from time to time be decided upon. They will then serve for a minimum of three years at sea in that rank, during which period they will work with the Executive Officer for training in Officers' duties and in Seamanship, and with the Specialist Officers for training and instruction in Gunnery, Torpedo, Navigation and Pilotage, and Engineering. The instruction is to be mainly practical.

The Midshipmen are to work with the Executive, Gunnery, Torpedo, Navigating and Engineer Officers for continuous periods of training. The detailed appropriation of the time will be left for the present with the Commanding Officer within the limits outlined in the following paragraphs, and with the proviso that about one-third of the whole time is to be spent with the Engineer Officer, and that the periods are to be arranged so that the time devoted to any particular branch shall not be so long as to entail any risk of the Midshipmen getting out of touch with other branches of their professional work.

The Marine Officer is to give such instruction to the Midshipmen as may be considered desirable by the Commanding Officer.

Instruction to Midshipmen is always to be given by Officers. This work is never to be delegated to Seamen Instructors.

Midshipmen are not to be employed more than is necessary on the Ship's clerical work, such as writing up Engineering, Gunnery and Torpedo logs, or filling in Returns.

Marks to a maximum of 50 are to be awarded every six months to indicate an Officer's professional qualities: these marks are in no way to be influenced by his conduct, but are to represent his Commanding Officer's opinion of his efficiency as an Officer in the actual performance of his practical duties. The mean of these marks is to be taken and awarded under "Former Service" in the Seamanship Examination. (See under Examination for rank of Lieutenant.)

It is considered that Saturday forenoons should, as a general rule, be utilised for lectures in the different subjects by the Instructing Officers, and, as the Midshipmen advance, they themselves should be directed to prepare and give short lectures on the various subjects.

The Midshipmen working with the Executive Officer should be employed in such day Watch in harbour as is required, and in night and day Watch at sea ; and also on all Ship's duties in charge of boats and parties, or work of a seamanlike character. Those working with the Lieutenants (G), (T) and (N), and with the Engineer Officer should spend their time in work connected with those special branches, under the direction of the Officer concerned. They should be available at all times when required by those Officers, and should therefore not be employed on any Ship's duties of a different character at times when they might be required by the Specialist Officers with whom they are working, except that at sea all Midshipmen, other than those who are working directly under the Navigating Officer and those doing duty in the Engine Room, will take observations and work out the Ship's position under the superintendence of the Naval Instructor.

The Commanding Officer will make such arrangements as he may think desirable in the interests of the young Officers in respect of their keeping night Watch at sea, relieving the deck, &c., and they are to be given at his discretion responsible duties in all branches of their work.

The subject of Navigation will now include Pilotage, the two forming one subject for classification. It is therefore essential that the Midshipmen specially told off to work with the Navigating Officer shall be under his direction entirely, both at sea and in harbour.

Midshipmen will be required to keep a book in which the Ship's reckoning is to be worked out and noted as laid down in Art. **295A.** of the Regulations. In lieu of the list of observations specified in Art. **294A.** the list specified below is to be substituted, and the regulations as to sending in the worked observations are to be amended as follows :—

On completing 12 months' service at sea, each Midshipman is to send in a book containing one complete set of the specified observations, certified by the Naval Instructor, or by the Navigating Officer if no Naval Instructor is borne, to have been taken and worked out by the Midshipman whose name they bear, and to be substantially correct. On completing two years and six months of service, each Midshipman is to send in a second book containing two complete sets of the specified observations, similarly certified.

On both occasions the books containing worked observations are to be forwarded for inspection to the Director of Naval Education, Royal Naval College, Greenwich. No marks will be assigned in respect of these observations, but in the event of the observations being found to be incorrect or incomplete, the Officer will be required to complete them before promotion to the rank of Lieutenant.

List of Observations.

I.—To find the Ship's position, by drawing position lines, from—

- (1) Two altitudes of the sun, one being on the meridian.
- (2) Two altitudes of the sun, one being near the meridian.
- (3) Two altitudes of the sun, neither being on or near the meridian.
- (4) One altitude of the sun and one of another celestial body, neither being on the meridian.
- (5) Two altitudes of celestial bodies other than the sun (preferably taken during twilight) at approximately the same time, neither being on the meridian.
- (6) An altitude of any celestial body and a bearing of a terrestrial object.

N.B.—Of the above observations, (2), (3), and (5) are to be worked out in two ways, the Ship's place being fixed (a) by drawing position lines, and also (b) by the use of tables, without drawing the lines.

II.—To find the error of the compass from—

- (1) Time by a deck watch and a compass bearing of the sun.
- (2) Time by a deck watch and a compass bearing of a celestial body other than the sun.
- (3) An altitude and a compass bearing of the sun.

III.—To find the error of a chronometer from equal or nearly equal altitudes of the sun or of a star taken on both sides of the meridian on the same day or on consecutive days, using an artificial horizon.

During the time a Midshipman is attached to the Engine Room Department it is primarily intended that he should become closely acquainted with the practical work of the Department, learning the methods and practice adopted in harbour for the care and maintenance of the machinery, as required to keep it in good order and efficiency; and acquiring the knowledge and experience under way which will enable him, by the time he goes up for examination, to take the duty of Engineer Officer of the Watch.

He should see such repair work as is going on in any Department and take part in examination of the hull and machinery.

He should also take advantage of such opportunities as present themselves of seeing engineering operations in the Dockyards.

Each Midshipman when working with the Department is to keep an Engineering Note Book with descriptions and detailed sketches of parts of machinery, gun and torpedo mechanisms, electrical and other auxiliary machines, and with accounts of any repairs he may witness, and the reasons for the repair. This book is to be periodically signed and dated by the Engineer Officer of the Ship and is to be examined and valued at the Preliminary Examination in Engine Room duties.

During the time he is attached to the Engine Room he should make sufficient acquaintance with the accounts kept of the receipt and expenditure of stores, and the Engine Room Register and defect list, to obtain an insight into the business management of the Department.

Reports are to be sent in at the end of four months on the routine instruction adopted in each Ship, with any further proposals that experience may suggest as desirable.

EXAMINATION FOR THE RANK OF LIEUTENANT.

After three years' service as Midshipmen Officers will present themselves for the Examination for the rank of Lieutenant.

This Examination will include a "compulsory" and a "voluntary" part. The former will be confined entirely to professional subjects and the latter will embrace a range of alternative subjects to suite the requirements of individual Officers.

The examination in all subjects will be conducted on shore at Portsmouth three times a year on dates approximating to the completion of three years' service at sea as Midshipmen. There will be no shore courses in any subject previous to the examination.

On presenting themselves candidates must produce the following certificates : -

- (1) A certificate showing that they have qualified before a Board of three Officers, of which the President must be of the rank of Captain, in the following subjects :—
 - (i) Handling of boats under oars and sail ;
 - (ii) Handling of boats under steam ;
 - (iii) Semaphore and Morse.
- (2) A certificate showing that they have qualified before a Board consisting of a Captain and two Engineer Officers as to their practical knowledge of Engine Room duties.
- (3) A certificate signed by the Engineer Officer of the Ship in which they have last served to show that they have satisfactorily performed the duty of Engineer Officer of the Watch.
- (4) A certificate signed by the Captain of the Ship in which they have last served to show that they have completed the prescribed list of observations and that the book containing the worked out observations has been sent to the Office of the Director of Naval Education for inspection.

The examination will consist of six parts, in each of which classes will be awarded. Of these the first five must be taken to qualify for the rank of Lieutenant.

1. Seamanship.
2. Navigation and Pilotage.
3. Engineering.
4. Gunnery.
5. Torpedo.
6. Voluntary subjects.

Marks for promotion will be given as at present according to the class obtained in each of the six parts of the Examination, a 1st Class counting 2 marks and a 2nd Class 1 mark; and the scale for promotion will be as follows:—

Marks.	Promotion.
12	- 9 months from date of seniority as Sub-lieutenant.
11	- 11 Ditto.
10	- 13 Ditto.
9	- 15 Ditto.
8	- 17 Ditto.
7	- 19 Ditto.
6	- 21 Ditto.
5	- 23 Ditto.

(The extra mark towards promotion at present allowed to Officers who obtain high marks in Parts I. and II. will not be continued.)

The voluntary group will include the subjects named below:—

- (1) Practical Mathematics.
- (2) Mechanics and Heat.
- (3) Electricity.
- (4) Advanced French.
- (5) Another Foreign Language, viz.:—German, Italian, Spanish, Russian, or Japanese.
- (6) Naval History.

Officers taking the voluntary group must offer at least two subjects, but may offer three. An Officer may obtain a 1st Class in the group by doing specially well in two subjects, or by reaching a somewhat less high standard in three.

The examination in Seamanship, both written and *virâ voce*, will be carried out by a Board of five Officers nominated by the Commander-in-Chief at Portsmouth, of whom the President is to be a Captain, and one of the members a Lieutenant (S).

The examination in Gunnery, both written and *virâ voce*, will be carried out by a Board of two or more Officers of the Gunnery School, nominated by the Commander-in-Chief at Portsmouth.

The examination in Torpedo, both written and *virâ voce*, will be carried out by a Board of two or more Officers of the Torpedo School, nominated by the Commander-in-Chief at Portsmouth.

The examination in Navigation and Pilotage, both written and *virâ voce*, will be carried out by a Board of two officers of the Navigation School, nominated by the Commander-in-Chief, with whom will be associated, for the theoretical parts of the examination, one or more Examiners nominated by the Director of Naval Education.

The examination in Engineering will be carried out by Officers nominated by the Commander-in-Chief at Portsmouth after communication with the Engineer-in-Chief and the Director of Naval Education.

The examination as a whole will be carried out under the general superintendence of the Commander-in-Chief with the assistance of the Director of Naval Education.

The latter will be associated for this purpose with each of the Boards and will prepare the time table, issue the necessary directions to Examiners, edit and print the papers, and collect and report the results in all subjects.

He will correspond directly with the Presidents of the various Boards of Examiners, and will communicate with the Commander-in-Chief as to the provision of rooms and any other details requiring local arrangement.

The marks awarded to candidates will not be made public, but will be communicated by the various Boards to the Director of Naval Education.

The Commander-in-Chief will nominate the Officers constituting the various Boards not less than six weeks before the commencement of each examination, and will inform the Director of Naval Education of their names.

The Boards will prepare question papers and send them to the Director of Naval Education not later than five weeks before the examination for printing and issue. They will include some questions involving applications of Mathematics, Mechanics, Heat and Electricity so far as they are relevant to the practical knowledge of the several subjects.

The examination in the five compulsory practical subjects will proceed continuously until completed. Officers will then go on leave, those taking the voluntary group returning to Portsmouth, after the leave, for examination in them, provided that they are found to have passed in the compulsory subjects.

On passing the examination in all the compulsory subjects Midshipmen will be promoted to the rank of Sub-Lieutenant with seniorities according to the time awarded on passing out of the Training Cruisers, viz.:—An officer who is awarded four months' time will date his seniority as Sub-Lieutenant three years after being rated Midshipman. An Officer with three and a half months' time will serve half a month longer as Midshipman, and so on. The promotion of Midshipmen who have been deprived of time will be delayed by the amount of time lost.

Officers who fail to pass in any of the five practical subjects will be sent to sea and will present themselves on the next occasion for examination in the subject or subjects in which they have failed. They will lose two months' time in respect of each subject in which they fail. A second failure will entail the liability to removal from the Service.

A Watch-keeping Certificate, as provided for under Art. 270,* paragraph 3, of King's Regulations and Admiralty Instructions, will be required before promotion to Lieutenant.

Officers must serve for not less than two years as Commissioned Officers at sea, the proportion of time as Sub-Lieutenant and Lieutenant depending on the class of certificate obtained; but at least one year must be as a Lieutenant in charge of a Watch in a sea-going ship. At the end of this service Officers will be selected to specialise in the various branches. Those who are accepted for Gunnery, Torpedo, Navigation or Engineering, will attend a course of two terms, approximately six months, at the Royal Naval College, Greenwich. This course of instruction will comprise such studies as will fit the Officers to prepare for the practical courses of specialisation. The marks obtained in the Lieutenants' course will be carried forward and contribute to determine the class taken on qualifying after the practical course at the specialist schools. These Lieutenants' courses will take place three times a year. Lieutenants who do not wish to specialise will also be allowed to go through a course at Greenwich when their services can be spared.

By Command of their Lordships,

C. I. THOMAS.

To all Commanders-in-Chief, Captains, Commanders, and Commanding Officers of H. M. Ships and Vessels at Home and Abroad.

APPENDIX.†

EXAMINATION FOR RANK OF LIEUTENANT.

SYLLABUS OF EACH SUBJECT.

- I.—Seamanship.
- II.—Navigation and Pilotage.
- III.—Gunnery.
- IV.—Torpedo.
- V.—Engineering.
- VI.—Voluntary Subjects.

I.—SEAMANSHIP.

FORMER SERVICE	-	-	(See details) -	-	-	-	-	50	50
JOURNAL	-	-	{ Neatness and quality of information -	-	-	-	-	50	{ 100
			{ Plans, sketches, mechanical drawings -	-	-	-	-	50	
			{ Fitting of rigging, preservation of rigging, hawsers, boat falls, tackles, strength of ropes, chains, &c., fittings of torpedo nets -	-	-	-	-	75	{ 250
One Paper	{	RIGGING	{ Sheers and derricks -	-	-	-	-	50	
		ANCHOR WORK	{ Working anchors and cables -	-	-	-	-	100	
			{ Fittings in connection with -	-	-	-	-	25	

* Enclosure 28, (page 167).

† For later syllabuses, see Enclosure 23 (page 148).

Oral	- {	OFFICER OF WATCH -	Duties of Officer of Watch - - - - -	100	300
		and	Rule of the road at sea - - - - -	100	
		RULE OF ROAD ORGANISATION	Towing, &c., rudder and screw - - - - -	25	
One Paper	- {	Internal economy - - - - -	75	300	
		Stationing of a ship's company (i.e., the officer should be well acquainted with the general principles underlying stationing a ship's company and know in detail the stations followed in the ship in which he is serving for fire, collision, taking and being taken in tow, getting out bower or sheet anchor, collision mat, working derricks, coming to an anchor, and preparing for sea, and in general the various systems followed in other stations such as dealing with fires in action, wounded in action, preparing for war and battle, &c.)	100		
		Organisation of fleet - - - - -	75		
- {	SIGNALS	Signal books - - - - -	50	1,000	

II.—NAVIGATION AND PILOTAGE.

1.—THEORETICAL NAVIGATION AND NAUTICAL ASTRONOMY.

Explanation of terms in ordinary use, the earth being regarded as a sphere.

Plane, parallel and middle latitude sailing.

Construction of Mercator's chart and table of meridional parts. Mercator's sailing.

Great circle and polar charts. Great circle and composite sailing by these charts.

Plotting approximate great circle and composite tracks on a Mercator's chart.

Easy problems in pursuit and in taking station on a ship in motion.

Theory of construction and use of the sextant, vernier, artificial horizon, and station pointer.

Principles governing the choice of terrestrial objects for fixing a ship's position.

The projections of a sphere on the planes of the horizon and of the equator.

Construction of the acceleration table and its use in finding the sidereal time.

Distinction between the meridian altitude and the altitude when a body "dips."

Calculation of G.M.T., S.A.T., and deck watch time of the meridian passage of a body.

Finding what bodies pass the meridian between two given times and which are suitable for observation.

Explanation of dip, refraction, and parallax (without proofs), and the circumstances in which any of these corrections are unreliable.

Approximate times of rising and setting of the sun and moon.

Calculation of the zenith distance and azimuth of a heavenly body, and construction of altitude and azimuth tables.

Methods of obtaining the compass deviation.

Explanation of methods of finding a position line from the altitude of a heavenly body and the G.M.T. :—

(1) By calculation of the zenith distance.

(2) By "chronometer" method.

(3) By ex-meridian altitude tables when the body is near the meridian.

Position line from altitude of Pole Star.

The uses of a single position line.

The choice of bodies for observations, and the effect of the angle of cut on a "fix."

Graphic determination of errors in the ship's position arising from errors in—

(1) Run between observations.

(2) Altitudes observed.

(3) Time by chronometer.

Elementary explanation of the causes of the tides and of the phases of the moon.

2.—PRACTICAL NAVIGATION AND PILOTAGE.

Section A.—Observations.

Finding a position line from an observation of any celestial or terrestrial object.

Fixing a ship's position by plotting two or more position lines, with and without an interval between the observations.

Fixing a ship's position from two observations without plotting, using traverse and other tables.

Error of chronometer from two sets of absolute altitude of the sun taken about the same bearing east and west.

Error of chronometer by absolute altitudes of stars east and west.

Section B.—Winds, Currents, Passages, Surveying.

General knowledge of the principal prevailing winds and currents of the globe, and of the principal routes adopted in making passages. The laws of revolving storms.

General knowledge of the principles involved in the construction of a small plan. To make an amendment to a chart.

Section C.—Compasses and Chronometers.

Terrestrial magnetism and the laws of induction. The magnetism of ships and its liability to change. Semicircular, quadrantal and heeling error and the principles of the mechanical correction. To adjust a ship for B, C, and D. To swing ship and analyse the deviation table, finding the approximate coefficients. Management of the various compasses and their appliances supplied. Precautions as to stowage and regulations as to safe distances from electrical appliances, &c. Construction of the compass to secure steadiness and freedom from friction error. Kelvin compass.

Management and care of chronometers, stowage and safe distances from electrical appliances. To compare and take times accurately. The value of the several methods of rating chronometers, and the means adopted for the elimination of errors.

3.—SUBJECTS OF ORAL EXAMINATION.

Knowledge of duties of navigation officer, *vide* "King's Regulations" and "Notes bearing on the Navigation of H.M. Ships."

Practical use of charts and sailing directions, and of the various books, tables, &c., supplied with the chart boxes. Fixing positions by all methods, including the station pointer. Shaping courses and allowing for tides and currents.

Principles of navigation in pilotage waters, use of leading marks, clearing marks, danger angles, and of lines of bearing to avoid dangers. To anchor a vessel in a pre-arranged position on a chart. Precautions when navigating in a fog, and method of utilising soundings.

General systems of lighting, buoyage, and fog-signals in use on the coast of the British Islands.

Practical use and management of meteorological instruments, sounding machines, patent logs, and other navigating appliances and the practical adjustment of the sextant.

Knowledge of tidal laws, use of Admiralty tide tables and tidal atlases.

Correction of compass.

The mooring board and the Battenberg indicator.

III.—GUNNERY.

This examination, except where otherwise specified, is to include only the guns and machinery of the ship in which the officer has served. Special regard is to be paid to making it a test of an officer's fitness to take charge of guns and men, and anything in the nature of the committal to memory of detailed drawings or tables of figures is to be avoided.

1.

Stripping.—To be able to strip, assemble, and to know the names, uses, and adjustment of all parts of guns and mountings of the secondary armament : 12-, 6- and 3-pdr. guns and mountings, overhead dismounting gear. Jacks and aiming rifles, gun curtains, rifles and pistols, sights, range-finders, and breech mechanisms of all guns 12-in. and below, of the types carried in the ships in which the officer has served.

Gun Drill.—To perform the duties of any number, to drill and instruct a gun's crew at a gun of any type carried in the ships in which he has served, with detail.

Turret Gun Drill.—To perform the duties of any number, to drill and instruct a turret crew. To answer questions on the machinery and fitting.

Ammunition.—A good knowledge of ammunition.

Field Training.—To perform accurately the rifle, firing and pistol exercises, and be able to instruct a class without detail. To perform and teach Squad and Company Drill, and to perform the duty of any officer or man in a company. To perform the duty of any number at field or field machine gun and to drill with detail. To know the action of the mechanism and to be able to strip and assemble any part of a mounting.

Hydraulics and Gun Mountings.—A good knowledge of the hydraulic gun machinery of the ships in which the officer has served. All must know the details of one 12-in. type and one 7·5 or 9·2 type of mounting.

2.

Organisation.—Internal organisation for war and battle. Organisation for repelling torpedo attack. Training of gun's crews. Ammunition supply and expenditure.

Mechanics of Gunnery.—Elementary internal and external ballistics. Pressure in a gun : how measured. Work done on the projectile. Muzzle energy. Energy of rotation. Measurement of muzzle velocity. Range and elevation. Use of range tables. Estimation of recoil : how the recoil is taken. Breech mechanism, obstruction and firing arrangements.

Elementary general notions of the stresses in guns. General features of construction with reference to strength. Characteristics of gun steel. Rifling. Driving bands. Erosion, its causes and effects.

Composition and general characteristics of propellants and high explosives. Characteristics of explosion and detonation. Tests of cordite. Principles of action in safety fuzes.

Sighting arrangements. Telescopic sights. Night sights. Range-finders. Calibration, causes affecting accuracy. General arrangements for fire control. General characteristics of armour and A.P. projectiles. Penetration. Action of soft cap. Types and arrangement of guns and armour in modern ships (British and foreign).

IV.—TORPEDO.

The Midshipman will be required to pass an examination in torpedo work in which he will be examined in the subjects named below. In particular, the examination should aim at finding out what knowledge the young officer has of the mechanism of the weapons and how they are used : the committing to memory of detailed sketches or tables of weights and dimensions is to be avoided.

A.—WHITEHEAD.

- (1) The functions and capabilities of a torpedo.
- (2) The details of head, air chamber, balance chamber, engine room, gyroscope, servomotors, valves, and all fittings in any type in the ships in which the Midshipman has served. He should be able to make simple diagrammatic sketches of the parts, and to explain their action.
- (3) The regulations affecting the care of torpedoes in practice and maintenance.
- (4) The tests made before running : preparing torpedoes for war.
- (5) Air pumps and air services. The submerged and above water tubes. The duties and drill at tubes, and dropping gear.
- (6) The director.
- (7) The pistol and net-cutter : how fitted, tested, and stowed.

B.—MINING.

- (1) Methods of offensive mining.
- (2) The spherical mine and its fittings (general but not a detailed knowledge).
- (3) Methods of clearing mine fields :—
 - (a) By countermining.
 - (b) By sweeping and creeping.
- (4) Demolition and explosives, with general knowledge of manufacture, stowage, and testing.

C.—PRACTICAL ELECTRICITY AND ELECTRICAL APPLIANCES.

- (1) Cells and batteries commonly used in the Service, their action and characteristics : general principles of the electric circuit.
- (2) Elementary theory of dynamos and motors, and general principles of their construction. Types of dynamos and motors.
- (3) Controllers, starters, and other special fittings used in connection with motors.
- (4) Care and maintenance of electric machines and elementary testing.
- (5) Switchboards and measuring instruments, use of instruments. Distribution of electric power in ships.
- (6) Electric lighting. Types of fittings. Systems of wiring. Testing for faults.
- (7) Search and arc lighting. Principle of the automatic searchlight lamp and how to use it practically. Control of searchlights.
- (8) Telephones and electric bells.
- (9) Guns circuits and night sights.
- (10) Fire control installations.
- (11) Elementary notions of Wireless Telegraphy. Sending and receiving apparatus.

V.—ENGINEERING.

In addition to the practical work already detailed in the Regulations, Midshipmen will study engineering subjects in accordance with the following syllabus :—

A.—*GENERAL PRINCIPLES.

Nature of Heat.—Temperature and its measurement.

Effects of Heat.—Coefficients of expansion of solids and liquids, and provision for expansion of parts in machinery.

Expansion of Gases.—Boyle's and Charles' laws : absolute temperature : applications of formula $PV = cT$.

Quantity of Heat.—Specific heat of solids and liquids, and special definition for gases.

Transférance of Heat.—Conduction : conductors and non-conductors : practical application to heating surfaces and cooling surfaces and lagging : convection : practical application to matters of boiler circulation, ventilation and funnel draught : Radiation.

Mechanical Equivalent of Heat.—First Law of Thermodynamics : natural sources of energy : transformation of heat energy into mechanical energy in heat engines and efficiency of the transformation.

Changes of State of bodies subjected to heat. Latent heat : evaporation and liquefaction.

Formation of Steam.—Dry saturated steam : superheated steam : wet steam : relation between temperature and pressure of saturated steam : relation between pressure and volume of dry saturated steam : heat of formation at constant pressure : work done during formation : work done during expansion : condensation of steam.

Efficiency of the Steam Engine.—Elementary principles of thermo-dynamics : influence of temperature range on the efficiency of engines : complete and incomplete expansion : stage expansion in steam engines : division of power in cylinders : reasons for adopting 4-cylinder 3 stage type in Naval Service.

Cylinder Condensation.—Action of cylinder sides : comparison of actual and theoretical indicator diagrams : effect of clearance : calculation of mean pressure : effect of cut-off on division of power in cylinders of compound engines.

Indicators.—Their construction and use : conditions for obtaining accurate diagrams : sketches of diagrams and description of faults in working deduced from diagrams (for steam, oil, and gas engines). Calculation of power from diagrams.

Turbines.—Elementary theory of the steam turbines : flow of steam. Speed of wheel for maximum efficiency : reason for high peripheral speed and how this can be reduced. Types of turbines.

* This part of the Syllabus relates chiefly to subjects which have been studied in the Cadets' Course, an elementary knowledge of which is to be kept up during service as Midshipman.

Simple Slide Valves.—Action and setting of valve, Zeuner's valve diagram, reason for double ported valves.

Mechanics of the Engine.—Elementary consideration of influence of inertia of reciprocating parts, Balancing.

Resistance to Propulsion.—Frictional resistance and wave making; rate of increase of resistance for moderate speeds; relation between power, speed and coal consumption; economical speed.

Screw Propeller.—Definitions of terms used, such as pitch, projected area, speed of screw, slip; advantages of twin screws.

Combustion.—Composition of coal and oil fuel; air supply required.

B.—MARINE ENGINES AND AUXILIARY MACHINERY.

Main Engines.—Modern forms of Direct Acting Propelling Engines; functions of each part and details of construction of the important pieces, such as cylinders, pistons, slide valves, link motions, important bearings and glands, condensers, air pumps, framing, adjustments for all moving parts.

Turbines.—Parsons' type; function of parts; details of construction of the important parts, such as rotors, stators or casings, blading, glands, thrust blocks, dummy pistons, couplings; average clearances allowed; general arrangements in ships; advantages and disadvantages over the direct-acting engine.

Internal Combustion Engines.—Functions of parts and details of parts peculiar to the engine, such as vapourisers, governing gear, igniters, oil supply pumps, air and exhaust valves, starting arrangements, advantages and disadvantages over steam engines.

Boilers.—Details of construction of the parts under pressure, casings and supports of cylindrical, Belleville, Babcock and Wilcox, and Yarrow large tube boilers; and Thornycroft, Yarrow, White Forster, Normand small tube boilers. Details of important boiler mountings, such as stop valves, safety valves, gauge glasses, feed regulators.

General Arrangements of main and auxiliary steam and exhaust leads of pipes and valves feed system, including evaporators and distillers with the drinking water connections; details of construction of main and auxiliary feed pumps, evaporators, fire and bilge pumps, blowing engines, fans and all auxiliary engines in engine and boiler rooms.

Auxiliary Machinery.—Hydraulic installation; general arrangement of pipes and valves for distributing power; detail of the pump and engine; governing devices; details of pipe jointing.

Refrigerating Plant.—Types used. Elementary principles of action. Principal details of dry air, carbonic acid and ammonia refrigerating machinery. Brine circulation. Arrangements for cooling magazines.

Electric Installation.—Types of engines used; detail of governor to provide for searchlight practice; use of oil engines; advantage over steam engines; details of parts peculiar to engine.

Air Compressing Plant.—Types of air compressors used and detail of pumps; details of packing, air cooling and lubrication; general arrangement of air leads and details of separator columns and storage reservoirs; pipe jointings.

Capstan Gear.—Type of engine; general arrangement of the plant; detail of differential valve, hauling and veering clutches, cable holders.

Steering Gear.—General arrangement of plant from rudder head to engine; detail of differential valve and hunting gear.

Miscellaneous.—A detail knowledge of engine room telegraphs, centering devices; steering engine and telegraph control shafting; means of changing position of control; detail of lubricating arrangements for all engines. Coal gear, transporters. Oil fuel burning and conditions required for good stoking.

C.—SHIP CONSTRUCTION.

Materials used in construction, and where used. Tests of materials; comparison of a ship to a loaded beam. Metacentric height. Angle of heel and trim due to change of distribution of weight; stability; tons per inch immersion. General knowledge (not detail dimensions) of the construction of plating of hull; beams, longitudinal and transverse framing; water-tight divisions of ships and means of access, doors and hatches; armour, position and attachment; protective decks; engine and boiler bearers and staying; stem, stern and A frames; stem tube fittings; coal bunker arrangements and coaling fittings, pumping, flooding and drainage arrangements of the hull generally. Ventilation systems. Steering arrangements. Types of rudders.

VI.—VOLUNTARY SUBJECTS.

I.—MATHEMATICS.

1. Elementary algebra and trigonometry. Quadratic equations. Solution of triangles with applications to practical problems. Circular measure, especially with reference to small angles. Sine and cosine of sum and difference of two angles.

Formulas connecting an angle and the double angle. Solution of trigonometrical equations in common use.

2. Spherical trigonometry so far as it is directly applicable in navigation.

3. Logarithms and their use in practical calculations.

4. Graphs of ordinary algebraic and trigonometrical functions. Use of squared paper. Solution of cubic equations by graphs. Use of graphs for approximate solutions in other cases.

5. Harmonic motion. Treatment of motion of piston, &c., connected by crank or eccentric to uniformly rotating shaft.

6. Methods of fixing position of a point in space. Rectangular co-ordinates: polar co-ordinates. Direction of a line in space. Projections of a line on planes of reference. Traces of a line and of a plane. Elementary notions in descriptive geometry. Plan and elevation. Simple problems on lines, planes, and rectangular solids.

7. Mensuration of areas and volumes. Simpson's rules. Planimeter. Mensuration of cylinder, pyramid, cone, sphere. Volumes of solids of revolution. Approximate determination of areas and volumes of irregular shape. Capacity of coal bunkers, &c.

8. Binomial theorem for all indices (without proof), especially as applied to approximations. Meaning of e . Series for e^x . Napierian logarithms.

9. Differentiation. Meaning of $\frac{dy}{dx}$. Values of $\frac{dy}{dx}$ when $y = x^n$, $\sin x$, $\cos x$, $\tan x$, &c., e^x , $\log x$. Easy cases of function of a function, products, and quotients. Meaning of $\frac{d^2y}{dx^2}$. Applications to gradients of curves, velocity, acceleration. Geometrical properties of curves as deduced from their analytical equations. Maxima and minima.

Simple applications in mechanics.

10. Integration of x^n , $\frac{1}{x}$, $\sin x$, $\cos x$, &c., e^x . Easy cases of integration by substitution. Applications to areas, mean ordinate, volumes of solids of revolution, moments of inertia, centres of gravity, centres of pressure, work done. Proof of Simpson's rule.

11. Integration of differential equations of the following types:—

$$\frac{dy}{dx} = \text{algebraic function of } x.$$

$$\frac{d^2y}{dx^2} = \text{algebraic function of } x.$$

$$\frac{dy}{dx} = k \sqrt{y} \text{ or some similar algebraic function of } y.$$

The solutions of the following equations to be known and verified:—

$$\frac{d^2x}{dt^2} + n^2x = 0, \frac{d^2x}{dt^2} = n^2x.$$

Nearly all the parts of this syllabus will be found treated in Castle's "Manual of Practical Mathematics" (Macmillan & Co.). Officers are recommended to read the following portions of that book and work the corresponding examples:—

Chapters I.-X.

- " XI, up to p. 231.
- " XIII, omitting pp. 286, 287, and Ex. XXXIII.
- " XIV.
- " XV, omitting pp. 330-334.
- " XVI.-XVII.
- " XIX.-XX.

2.—MECHANICS AND HEAT.

Units. Dimensions of units. Vector quantities. Force and motion. Relation between force, mass, and acceleration. Relation between force, time, and momentum. Action and reaction. Newton's laws of motion. Conservation of momentum. Recoil: impact. Simple applications.

Work. Power. Energy. Conservation of energy. Equilibrium of forces. Force polygon. Resultant of a system of forces in one plane. Parallel forces. Moment of a force. Couples. Resultant of any system of forces. Centre of gravity. Friction: Coefficient of friction. Friction of rope on bollard or capstan barrel. Applications relating to simple machines, such as tackles, capstan, screw-jack, Weston's pulleys, worm gearing. Velocity ratio and mechanical advantage in machines. Efficiency of machines.

Applications relating to stresses in the parts of spans, jointed frames, derricks, sheers, &c.

Fluid pressure. Centre of pressure on plane area. Pressure on watertight doors and bulkheads in a flooded compartment. Resultant pressure on floating or submerged body. Equilibrium of floating bodies. Metacentre. Stability. Calculation of metacentric height for small displacements. Practical determination of metacentric height. Changes in trim and heel due to loads. Common hydraulic machines. Hydraulic transmission of power.

Fluid friction. Nature of the resistance to propulsion of ships. Relation of horse-power to speed.

Uniformly accelerated motion. Falling bodies. Projectiles. Uniform motion in a circle. "Centrifugal force." Governors and other practical applications.

Rotation of a rigid body about a fixed axis. Angular velocity and angular acceleration. Moment of inertia. Energy of fly-wheels. Centre of percussion.

Simple harmonic oscillations. The simple pendulum. Elementary consideration of vibration and of oscillation of a rigid body about a fixed axis. Influence of frequency of impulse in producing oscillation. Application to rolling of ships, &c.

Influence of inertia in the action of a steam engine. Effects of the acceleration of the reciprocating parts on the work done on the crank. Balancing of engines.

Elementary principles of the strength of materials. Elastic and non-elastic strain. Safe stress, Tensile strength and shearing strength. Behaviour of materials under tension, compression, torsion, and bending. Elastic limit. Hooke's law. Young's modulus of elasticity. Modulus of rigidity. Ordinary tests of metal. Simple applications relating to the strength of tie-rods and of joints and fastenings. Simple cases of loaded beams. Bending moments. Relation of greatest intensity of stress to bending moments. Round shaft under torsion. Relation of greatest intensity of stress to twisting moment. Torsion Dynamometer.

Heat, its nature, measurement and effects. Temperature. The absolute zero explained by reference to the properties of an ideal perfect gas. Transformation of heat into work. Ideal heat engine. Carnot's cycle with a perfect gas for working substance, and with steam or other vapour. Points in which the cycle in a real steam engine differs from Carnot's. Ideal limit of efficiency. Action of a heat engine reversed, to give a refrigerating process. The actual cycle in a refrigerating machine using carbonic acid or ammonia.

3.—ELECTRICITY.

Characteristics of cells used on board ship: Menotti and Leelanéché: Their internal resistance and depolarisation. Storage batteries, their general construction and behaviour during charge and discharge.

Ohm's law and its application to simple and divided circuits: effect of internal resistance of cell: potentiometer method of measuring E.M.F.: principle of the Wheatstone's Bridge and other methods of measuring large and small resistances: effect of temperature on the resistance of metals and insulating materials. Electric thermometers.

Galvanometers: needle, mirror and suspended coil types. Use of shunts. Ammeters and voltmeters: soft iron moving coil, Weston's and Cardew's.

Heating effects: heat and mechanical equivalents of electrical energy. Electric power transmission, efficiency of transmission.

Magnetic substances: permanent magnets: magnetic field. Magnetic effects of electric current: electromagnets.

Electric telegraphs, a general knowledge of the methods and types of apparatus in common use. Duplex working.

Quantitative meaning of lines of magnetic force: electro-magnetic absolute units and their relation to practical units. E.M.F. as a rate of cutting lines of force. The magnetic circuit: magneto-motive force: permeability and its measurement by ballistic galvanometer: ampère turns for a given magnetic flux: Magnetisation curves for iron and steel: saturation: hysteresis.

Terrestrial magnetism. Deviation of the compass: deviation diagram obtained by swinging the ship. Components of the deviation, semicircular and quadrantal. Permanent and induced magnetism of ship, and the effects of each. Sub-permanent magnetism, how affected by firing, &c. Change of deviation due to change of place. Heeling error. Use of permanent magnets, Flinder's bar and spheres to neutralise magnetic fields due to ship. Effects of current-bearing conductors near binnacle. Use of deflector and heeling error instrument.

Elementary principles of continuous current dynamo: armature (drum and ring), field magnets (series, shunt and compound winding), commutator, brushes.

Energy losses in dynamo, direct and indirect, mechanical and electrical: friction, C²R losses in armature and field magnets, eddy currents in iron and copper, and hysteresis. Armature reaction: position of brushes, sparkless commutation. Electrical and commercial efficiencies of dynamo. Typical characteristic curves of series and shunt dynamos.

Motors: back E.M.F.: calculation of mechanical power and driving torque generated. Effect of varying field strength when torque and impressed E.M.F. are constant. Effect of varying impressed E.M.F., (1) when magnets are saturated, (2) when field strength changes with E.M.F.

Behaviour of series and shunt motors and their suitability to different requirements: speed regulation of shunt motors. Efficiency and maximum output.

The phenomena of electrification by friction: charge, potential, capacity, condensers, electrostatic induction, electrophorus, specific inductive capacity: lightning conductors. Lines of electric force: dielectrics, nature of electric discharge.

Elementary ideas regarding alternating currents: virtual amperes and volts: power in an alternating circuit. Transformers: self-induction of circuit: choking coils.

Elementary outline of principles of wireless telegraphy (treated as far as possible non-mathematically). Electric oscillations produced by discharge of condenser: apparatus needed for the production of damped trains of oscillations: induction coil, condensers, inductance coils and oscillation transformers. The production of electric waves by oscillation in an open circuit: radiation from a Marconi earthed oscillator and from a Poulsen arc. Methods of detecting electric waves: coherers, magnetic detectors. Timing of receivers.

Officers are advised to read the following Articles in "Technical Electricity" by Davidge and Hutchinson (University Tutorial Press):—

15-21, 26-30, 83-94, 98-105, 107, 109, 110-126, 132, 134, 142-144, 152, 154-163, 196-209, 217-219, 221-262, 264-270, 275-280; or

The following pages in "Electrical Engineering" by Slingo and Brooker (Longmans, Green & Co.), 1903 edition:—

13, 43, 74-170, 183-204, 211-222, 226-272, 305-368, 388-400, 418-421, 451-470, 538-546, 557-567, 593-616, 747-751.

Also the following articles in "The Principles of Wireless Telegraphy" by J. A. Fleming:—

Chap. 1, arts. 1, 7, 11-13, 14 (pp. 73-76). Chap. 6, arts. 1-4, 8. Chap. 7, art. 5.

For the Correction of the Compass, the Elementary Manual for the Deviations of the Compass should be consulted.

4.—FRENCH.

The standard of the examination in French will be somewhat higher than that reached on passing out of Dartmouth College. Some acquaintance with the maritime idiom in general use among Naval Officers will be expected, but not the technical terms which belong to special branches only.

5.—OTHER FOREIGN LANGUAGES.

In the other foreign languages specified (German, Italian, Spanish, Russian, and Japanese) the paper will be of an elementary character, and the candidate will be expected to have a fair knowledge of ordinary idiom only. In Japanese no acquaintance with the written character will be required.

Candidates taking any of these languages are required to notify their intention to the Director of Naval Education at least three months before the examination, specifying the language in which they desire to be examined.

6.—NAVAL HISTORY.

Midshipmen who intend to offer Naval History as a voluntary subject will study in detail the events of one or more of the past wars.

The study is to be directed to a clear understanding of the events leading to the war; the influence of foreign policy on the operations of the several campaigns; the articles of peace; the general plan on which the war was conducted; the operations of the Naval and Military forces in so far as they are related; the defence and attack of commerce, and its influence on the main operations; and any progress in organisation, tactics or ship design which are features of the period under review.

The period, which will form the subject of the Examination for Lieutenant, will be notified when Midshipmen leave the Training Cruisers.

The following is a representative list of periods, and of the names of books, which may be referred to, in connection with each:—

PERIOD I.

Commonwealth and Dutch Wars to the Treaty of Westminster, 1674.

Authorities.

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PERIOD II.

The Wars of Louis XIV., 1638, to the Peace of Utrecht.

(League of Augsburg and Spanish Succession.)

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PERIOD III.

The Wars with France and Spain, 1718–1763.

(Spanish War, Austrian Succession, Seven Years' War.)

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PERIOD IV.

The War of American Independence.

PERIOD V.

The Revolutionary and Napoleonic Wars and the American War of 1812 (1792–1815).

Enclosure No. 15 in Third Report of Education Committee, dated 13th September 1912.

EXTRACT from the ADDENDA of 1911 to the KING'S REGULATIONS and ADMIRALTY INSTRUCTIONS, 1906.

TRAINING AND EXAMINATION OF OFFICERS.

SECTION II. CADETS, MIDSHIPMEN AND SUB-LIEUTENANTS.

293A. On leaving the Training Cruiser, Midshipmen will serve for a minimum of three years at sea in that rank, during which period they will work with the Executive Officer for training in Officers' duties and in Seamanship, and with the Specialist Officers for training and instruction in Gunnery, Torpedo, Navigation and Pilotage, and Engineering.

2. The instruction is to be mainly practical, but facilities are to be afforded for voluntary study as indicated in Clause 31.

The instruction is always to be given by Officers. This work is never to be delegated to Seaman Instructors.

3. The general System of instruction to be followed is indicated in the following clauses. In regard to details, however, the Commanding Officer is to exercise his discretion in directing the work of the Midshipmen, the object being to secure that when the Midshipman's sea service as such is completed he will be fit, without further instruction, to perform satisfactorily all the duties which may be required at sea of a Sub-Lieutenant or Lieutenant, having a competent practical knowledge not only of Seamanship and the general duties of an Officer, but also of Gunnery, Torpedo, Engineering, and Navigation.

4. To this end a combination of two methods is to be employed in the training of Midshipmen. They are to learn their work—

a. By being attached to the several Officers of the ship for definite periods, during which they will observe and take part in what the Officers do in the performance of their several duties.

b. By means of systematic instruction in the several subjects in which professional knowledge has to be acquired. This instruction is to be given partly by lectures or less formal tuition and partly by making the Midshipmen carry out practical work which need not necessarily be part of the usual routine, but may be designed to serve an instructional purpose.

5. For the purpose of carrying out their instruction, the Midshipmen are to be divided into groups, so that each of the specialist Officers will have one or more Midshipmen acting under his direction for an assigned period; and each of the Officers concerned is to be responsible for seeing that the Midshipmen so attached are usefully employed during that period in acquiring knowledge of his branch. The period during which each Midshipman is serving in each branch is to be recorded, and his progress is to be noted in the record over the signature of the Officer who for the time is responsible for it. A form of History Sheet for such records is included in the form of Junior Officers Certificate (Form E. 190).

6. Care is to be taken that the Midshipmen engaged under any specialist Officer in this manner not only see and take part in what he is doing, but understand the intention and character of the work on hand, the Officer giving such explanations as may be necessary.

7. It is highly important that the Midshipmen should learn early to assume the habit of responsibility which is essential to the formation of their character as Naval Officers. Officers in charge of Midshipmen are accordingly to endeavour to test their fitness for responsibility, and should not hesitate to delegate responsible duties whenever possible, at the same time watching the manner in which the Midshipmen acquits himself.

8. Midshipmen are not to be employed more than is necessary on the Ship's clerical work, such as writing up Engineering, Gunnery, and Torpedo logs, or filling in Returns.

9. Marks to a maximum of 50 are to be awarded every six months, on Form E. 190, to indicate an Officer's professional qualities; these marks are in no way to be influenced by his conduct, but are to represent his Commanding Officer's opinion of his efficiency as an Officer in the actual performance of his practical duties. The mean of these marks is to be taken and awarded under "Former Service" in the Seamanhood Examination. (See Appendix XXVIA. (1).)

10. When Midshipmen are first appointed to a Ship on leaving the Training Cruiser, it is desirable that they should in the first place make a general acquaintance with the various departments of the Ship before settling down to learn the work of the departments in more detail. Accordingly, a first short period is to be spent in each department, and after this is over they are to enter on a routine in which a considerably longer time is spent continuously in each.

11. On first going to sea, Midshipmen will serve in large ships, hereafter referred to as "A" Ships, in which there are senior Midshipmen, and in which a Naval Instructor is borne. In his second year at sea each Midshipman is to be transferred to another Ship not carrying a Naval Instructor, which will be called a "B" Ship. The number of Midshipmen borne in any "B" Ship is to be comparatively small. Towards the end of his second year the Midshipman is to return for the third and final period to a Ship of the "A" class with a Naval Instructor.

12. The whole time of service will accordingly be divided into three periods, the exact length of which may be somewhat elastic. The length of the first two periods will be subject to the discretion of the Commander-in-Chief of the Fleet in which the Midshipman is serving. Each Midshipman will in the first instance be appointed to a Ship of the "A" Class. After a service in this Ship of not less than one year he is to be lent by the Commander-in-Chief to a Ship of the "B" class, and he may at the discretion of the Commander-in-Chief be transferred from one to another of such "B" Ships during his second year so as to obtain experience in Ships of more than one type, including Destroyers (for short periods) and small Cruisers or Scouts. The

Commander-in-Chief is to inform the Admiralty of any transfers of Midshipmen to "B" Ships or from one "B" Ship to another, reporting them on Form S. 594 in the usual manner. At the end of the period spent in "B" Ships the Midshipmen will be appointed by the Admiralty to an "A" Ship, and will spend in it the final year preceding his examination. The final period, like the first period, will in any case be not less than one year. The middle period will accordingly in no case exceed one year, and may be somewhat less.

13. The number of Midshipmen nominally borne by each "A" Ship will be about 24, of whom about eight will be lent to Ships of the "B" class, leaving about 16 actually under training in the "A" Ship at any one time. These will be of two seniorities, about half being in their first and half in their third year.

14. Those actually borne are to be divided into three sections for training in rotation in the three branches :

- I.—Seamanship and general deck duties ;
- II.—Gunnery, Torpedo, and Navigation ;
- III.—Engineering.

15. When Midshipmen first join an "A" Ship from the Training Cruiser they are to spend two weeks in each of the three branches in order quickly to make a general acquaintance with each.

16. After this, the period spent in each branch is to be two months, each Midshipman completing the cycle of the three branches in six months. In reckoning the two-months period at the end of which the Midshipmen are to change over from one branch to another any time lost for instruction through general leave being given to the Midshipmen is not to be included. Each section of Midshipmen should have had two months of actual instruction in each branch before passing on to the next.

17. After this cycle is completed, it is to be repeated, but with the period shortened from two months to one and a half months, or as much as may be necessary to secure that the cycle will be complete within the year. This is in order that Midshipmen may have a second period of instruction in each branch before they leave the Ship. The same procedure applies during the third year of service.

18. In general, each of the three sections is to include both senior and junior Midshipmen, and as far as practicable seniors and juniors are to work together in the several branches and in any sub-division of the groups.

19. The Commander will be responsible for the work of the Seamanship Section. The following duties and subjects of instruction are included :—

Duties.

Watchkeeping at sea and in harbour.

Boat work.

General evolutions.

Watch evolutions.

Divisional work under Officers of Divisions.

Midshipmen of Hundreds for Open List and Payments.

Watch, Station, and Quarter Bills.

Coaling Ship.

Taking sights at sea.

Instruction.

Rigging, including Derricks, Sheers, Tackle, Strains for wire and hemp, splicing wire, practical fitting of gear, Sailmaking.

Methods of rigging Ship and collier for coaling.

Manœuvring.

General duties of Officer of the Watch ; use of Mooring Board and Battenberg Indicator ; taking in tow.

Anchor work, Ship and boats.

Boat work.

Rule of the Road.

Signals, including Fleet work.

Organisation, including internal economy ; berthing ; messing ; dispositions of stores ; summary punishments.

The Midshipmen in this section should only be employed on Day Watch when the Ship is in Harbour, and the Commanding Officer is to make such arrangements as he may think desirable in the interests of the young Officers in respect of their keeping Night Watch at sea, relieving the deck, &c.

20.—*a.* The Officers responsible for instruction in Gunnery, Torpedo, and Navigation will be the Gunnery, Torpedo, and Navigating Officers respectively.

b. As a rule there are to be five or six Midshipmen in the section, who are to be divided into sub-groups (generally of two each) to work with these three officers, changing over at such intervals as will secure a more or less equal division of the time. But when there are lectures or formal instruction of a kind which it is desirable that the Midshipmen should attend together, all the Midshipmen of Sections I. and II. who can be spared from particular duty are to attend. It is, however, to be understood that the Officer to whom they are for the time attached has the first claim on their attendance. The Midshipmen working with the Navigating Officer are to be under his direction entirely both at sea and in harbour.

c. The Officers responsible for the instruction of the Midshipmen in the several subjects are to arrange for such lectures or other formal lessons as may be necessary to give the Midshipmen an opportunity of understanding the matter specified in the syllabus. No attempt should be made to regard any part of the syllabus as matter to be crammed up for examination; but care should be taken that Midshipmen have such a general comprehension of the various professional subjects as is required for the due discharge of their duty as Naval Officers, regard being had to the fact that they will be expected to qualify for the rank of Lieutenant, as a result of their sea service, without shore courses, and also to the fact that those who may afterwards be selected for specialisation will then have opportunities of acquiring further knowledge in the special branch.

21. All Midshipmen working in Sections I. and II., except those who are specially excused on account of other duty, are to work out the reckoning and take daily observations when the Ship is at sea and the weather permits, and are to find from them the position of the Ship.

Those who are, for the time, working with the Navigating Officer are to do this under his direction; the others are to do it under the direction of the Naval Instructor in "A" Ships, and under the direction of the Navigating Officer in "B" Ships.

22. The sights are to be worked out and noted in a work book, which is to be inspected from time to time by the Captain. In view of the general necessity for Junior Officers to become proficient in all the branches of their duties, much importance is attached to their being trained to take observations quickly and accurately. They are, besides taking sights at sea daily, to be afforded opportunities for practice in taking observations on shore with the artificial horizon, in taking bearings with the compass, in fixing the position of the Ship by cross-bearings, sextant angles, &c., as well as in the use of the Tide Tables.

23. On completing 12 months' service at sea, each Midshipman is to send in a book containing one complete set of the observations specified in Clause 24. These observations are to be initialised by the Naval Instructor or Navigating Officer as having been taken and worked by the Junior Officer, and they are to be revised in red ink by him. On completing two years and six months of service, each Midshipman is to send in a second book containing two complete sets of the specified observations (see Clause 24) similarly certified.

On both occasions the books containing the worked observations are to be forwarded for inspection to the Director of Naval Education, Royal Naval College, Greenwich, together with a list (S. 431A.) showing the observations completed by each Junior Officer, certified by the Naval Instructor or Navigating Officer. No marks will be assigned in respect of these observations, but in the event of the observations being found to be incorrect or incomplete, the Officer will be required to complete them before promotion to the rank of Lieutenant.

24. List of Observations:—

I. To find the Ship's position, by drawing position lines, from—

- (a) Two altitudes of the sun, one being on the meridian.
- (b) Two altitudes of the sun, one being near the meridian.
- (c) Two altitudes of the sun, neither being on or near the meridian.

- (d) One altitude of the sun and one of another celestial body, neither being on the meridian.
- (e) Two altitudes of celestial bodies other than the sun (preferably taken during twilight) at approximately the same time, neither being on the meridian.
- (f) An altitude of any celestial body and a bearing of a terrestrial object.

N.B.—Of the above observations, (b), (c), and (e) are to be worked out in two ways, the Ship's place being fixed (i) by drawing position lines, and also (ii) by the use of tables, without drawing the lines.

II. To find the error of the compass from—

- (a) Time by a deck watch and a compass bearing of the sun.
- (b) Time by a deck watch and a compass bearing of a celestial body other than the sun.
- (c) An altitude and a compass bearing of the sun.

III. To find the error of a chronometer from equal or nearly equal altitudes of the sun or of a star taken on both sides of the meridian on the same day or on consecutive days, using an artificial horizon.

25. Midshipmen of Sections I. and II. may be combined for evolutions, for fire control drill, and for physical drill, subject to the condition as before that those are excused who are carrying out important duties under the Officer to whom they are for the time attached. Midshipmen in Section I. should as far as possible, and subject to the same conditions, be allowed to attend the professional lectures in the subjects of Section II.

26. All Midshipmen are to attend at their General Quarters Stations. Midshipmen in the Engineering Section are to be regarded as part of the Engine-Room Staff for General Quarters.

27.—a. The Engineer Officer of the Ship is responsible for the instruction of Midshipmen in Engineering.

b. Those Midshipmen who belong to the Engineering Section are to be regarded as members of the Engine-Room Staff for the time being, and are not to be required to undertake extraneous duties.

c. Their training is to proceed chiefly by their taking part in the daily Engineering work of the Ship, under the supervision of the Engineer Officers, who are to arrange for supplementing this routine by such lectures as may be necessary.

d. Before joining the Fleet, Midshipmen will have been instructed in most of the principles that are involved, as well as in the use of tools and the handling of engines. It should be seen that they bring their College and Cruiser note-books with them, and that they revise these in connection with their work.

e. Each Midshipman when working with this Section is to keep an Engineering Note-Book with descriptions and detailed sketches of parts of machinery, gun and torpedo mechanisms, electrical and other auxiliary machines, and with accounts of any repairs he may witness, and the reasons for the repair. This book is to be periodically signed and dated by the Engineer Officer of the Ship, and is to be examined and valued at the Preliminary Examination in Engine-Room duties. (Art. 299, Clause 1 a, V.)

f. During the time he is attached to the Engine-Room he should make sufficient acquaintance with the accounts kept of the receipt and expenditure of stores, and the Engine-Room Register and defect list, to obtain an insight into the business management of the department.

g. The Engineer Captain of each Fleet is to make it a part of his duty to supervise generally the Engineering instruction of Midshipmen throughout the Fleet by visits to Ships to see that the directions for the training of Midshipmen in the Engine-Room are being properly carried out, and he is to be responsible for recommendations on

the subject to the Commander-in-Chief or Admiral in command. This general supervision is not in any way to interfere with the responsibility of the Engineer Officer of the Ship, or with the authority of the Captain in this matter.

At Sea.

h. The Midshipmen of the Engineering Section are to keep regular watch (with Commissioned Officers if possible), preferably in three watches, so that they may always work with their own watch of stokers. But during their first year Midshipmen keeping engineering watches are to be excused from duty between the hours of 10 p.m. and 5 a.m.

i. They should begin by taking part in the routine, blowing down boilers, taking densities, making entries in the engine-room register, handling engines, taking indicator diagrams to be worked out when off watch, and looking after bearings, evaporators, and auxiliary machinery. They should then do the duty of Stoker Petty Officer of the Engine-Room, and when efficient in this take charge as Stoker Petty Officer in the stokehold, then learn to take charge of an engine-room, and finally of all boiler rooms. It is to be noted in the Midshipman's History Sheet when he has performed these duties.

j. Before he is granted the certificate of the Engineer Officer of the Ship in which he last serves, to show that he has satisfactorily performed the duty of Engineer Officer of the watch, each Midshipman should have had complete charge of a watch in the Engine-room and should have been responsible for it.

In Harbour.

k. The Midshipmen of the Engineering Section are to be detailed separately or in groups of twos as may be convenient for the following duties :—

- (1) Senior Engineer's Assistant.
- (2) Boilers.
- (3) Outside Machinery.
- (4) Double Bottoms.
- (5) Boats.

l. Two of these duties may be combined in case the number of Midshipmen is insufficient to provide one for each.

m. The Midshipmen are also to take turns as Midshipman of the day to help the Engineer Officer of the day. About three weeks should be spent on each duty, not more than three duties being attempted in a two-monthly period. During the Midshipman's time in each Department he is expected to acquire a good knowledge of it, learning where spare gear is kept, when tests are due, and so forth. He should supervise the hands, attend to the cleanliness of the department, see valves worked and engines started and running, take notes of the work going on, and make sketches of pipe-leads and details of machinery. The Midshipman of the boats should make frequent trips in the boats' engine-rooms and stokeholds, report defects, and see them made good.

n. When working as senior Engineer's Assistant the Midshipman is to have an opportunity of obtaining insight into the adjustment of main and auxiliary engines, and the executive duties and organisation of the Department. He is to write up the register and help in arranging the work of the hands.

o. The Midshipman of the day is to help the Engineer Officer of the day in ordinary routine work, divisions, quarters, night rounds, &c. He should take charge of all minor operations such as starting, cleaning and working of evaporators, renewing filter cartridges, and finding leaks.

p. It is not expected that Midshipmen can at once undertake the supervision of Engine-Room Artificers' work, but they should have as much opportunity as possible of gaining insight into it, so that with further sea experience they will be fitted to direct ordinary repair operations.

q. Care is to be taken to instruct the Midshipmen during General Quarters, Fire and Collision Quarters, &c. in the duties of Engineer Officers on those occasions.

v. In case the Ship does not spend enough time at sea to make all Midshipmen well acquainted with engine-room watchkeeping without keeping the night watches, these may be kept. For the same reason it may be desirable to give Midshipmen a certain amount of auxiliary watchkeeping in harbour, by making each Midshipman in turn keep the morning (auxiliary) harbour watch, and in such cases they should be given complete charge as soon as possible.

s. Midshipmen should be enabled to take advantage of such opportunities as present themselves of seeing engineering operations in the Dockyards.

28. The foregoing directions relate particularly to "A" Ships. In "B" Ships the routine should be modified to suit the conditions of the type of Ship concerned, having regard also to the number of Midshipmen to be provided for. But in all cases the general principle is to be adhered to, that the Midshipmen are to learn their duties chiefly by taking part in the work of the Ship under the several Officers, and that the Officers are to be responsible for seeing that they do this and for giving whatever instruction is needed in the several professional subjects. It is also to be understood that in arranging a routine suitable for smaller Ships, the proportion of time allotted to the three chief branches of work is to remain substantially the same as in the routine laid down for "A" Ships, about one-third of the total being allotted to engineering.

29. Midshipmen will be required to attend the lectures on professional subjects in the several sections unless specially excused, and it will be open to any Midshipman of another section to attend whose duties admit of it. This rule applies not only to lectures given by the various Executive and Engineer Officers, but also to lessons in Navigation or other professional subjects given by the Naval Instructor. Saturday forenoon should as a general rule be utilised for lectures. As the Midshipmen advance they themselves should be directed to prepare and give short lectures on the various subjects.

30. Midshipmen may be excused from the Naval Instructor's lessons in navigation when they have, in his opinion, reached a sufficiently high standard and may be more usefully employed in other work.

31. Lectures or lessons on the voluntary subjects of the syllabus are to be arranged for as far as may be practicable, but the attendance of Midshipmen at such lessons will be voluntary. Midshipmen should be encouraged to select voluntary subjects of study, and should have whatever assistance can be given. In "B" Ships a suitable place is to be reserved for study when the size of the Ship admits of this being done.

32. The Marine Officer is to give such instruction to the Midshipmen as may be considered desirable by the Commanding Officer.

Enclosure No 16 in *Third Report of Education Committee*, dated 13th September 1912.

Royal Naval College, Dartmouth.

ORDERS FOR CAPETS AWAY IN MOTOR BOAT.

Now in force.

Cadet in charge.

Before going, names of Cadets in boat to be left in the Office at College.

Boat to remain in sight of the ship unless the Commander's permission has been obtained otherwise.

Cadets are to satisfy themselves that the oars and rowlocks are in the boat before casting off from the buoy.

The boat is to be kept as clean as possible.

If any trouble is experienced or defect develops, it is to be reported to Engineer Lieutenant Start, or to the Engineer Lieutenant of the Term as soon as possible.

The boat is to be tied up to the buoy before dark; the engine cover is to be properly fixed, and the petrol cock shut off before leaving.

Royal Naval College, Dartmouth.

Cadet in charge.

ORDERS FOR CADETS AWAY IN STEAM BOAT.

Boat to remain in sight of the ship unless the Commander's permission has been obtained otherwise.

Before going, names of Cadets in boat to be left in Office at College.

There must always be one Cadet in the Boat.

The boat is to be kept as clean as possible.

Overall suits are to be worn.

If any defect develops, the boat is to return at once, and the matter is to be reported to Engineer Lieutenant Murray, or to the Engineer Lieutenant of the Term as soon as possible.

On returning, the boat is to be taken alongside the dynamo boat before dark, and turned over to the Stoker P.O. there.

Cadets are to satisfy themselves that the auxiliary feed pump will pump water into the boiler before casting off.

The greatest attention is to be paid to the water level, and fires must be drawn at once if it goes out of sight.

Cadets must not land in Overalls outside the College grounds.

Enclosure No. 17 in Third Report of Education Committee, dated 13th September 1912.

Form E.—190 .

(Authority:—King's Regulations and Admiralty Instructions, Articles **297** and **299.**)

RECORD AND CERTIFICATES

as amended by the Committee

of Mr. _____ during his service as Naval Cadet, Midshipman and Sub-Lieutenant, including Results of the Examination for the Rank of Lieutenant.

Signature in full of the Officer to whom these Certificates relate.

Contents.

1. Naval Cadet Passing-out Certificate.
2. Certificate on leaving Training Cruiser.
3. Record of Efficiency in all branches ("Former Service" *).
4. Qualifying Certificate—Boats and Signals.
5. " " Engine Room Duties.
6. " " Navigation Observations.
7. Certificates of Seamanship, Navigation and Pilotage, Gunnery, Torpedo, and Engineering Boards.

N.B.—This form is to be kept in duplicate for every Officer until he has passed for the rank of Lieutenant, and passed from ship to ship, addressed to the Commanding Officer. It is to be handed to the officer when he is due for examination for the rank of Lieutenant and produced by him at his professional examinations.

One copy is to be forwarded to the Admiralty when the results of all the examinations are recorded in it, the other is to be retained by the officer.

The attention of officers is called to the fact that they are themselves responsible for obtaining all the Certificates, &c., required throughout their service, and that applications should not be made to the Admiralty for copies of Certificates, unless every other means of obtaining them has failed or Certificates have been lost in unusual and exceptional circumstances.

* *Vide "Record of Efficiency in all Branches," page 121.*

Number on Books of R.N. College, Dartmouth
 In pursuance of the Orders of the Lords Commissioners of the Admiralty,
 Mr. , Naval Cadet, borne on the books of : -

FROM TO

Royal Naval College, Osborne,
 " " " Dartmouth,
 has been examined in the subjects of the authorised curriculum, and is entitled to a
 Class in the subjects of College Course.

His conduct under training has been satisfactory.

He can swim.

He receives the following allowance of sea time in months : -

Date of Birth - - - - -
 Date he should be rated Midshipman - -
 Date he should pass for the rank of Lieutenant,
 provided he has completed his sea time - -
 Date to be advanced to Sub-Lieutenant - -

Captain,

Date R.N. College, Dartmouth.

CERTIFICATE ON LEAVING TRAINING CRUISER.

This is to certify that Mr. , Naval Cadet, has been through a course of training on board this ship.

His knowledge and ability are : -

In Seamanship - -
 In Navigation - -
 In Pilotage - -
 In Gunnery - -
 In Torpedo and Electrical Work - -
 In Engineering - -

He has shown attention to his work, and his conduct has been .

Given on board His Majesty's Ship this day of 19 .

Captain.

RECORD OF EFFICIENCY IN ALL BRANCHES ("FORMER SERVICE").

Awards for ability as an officer in all branches ("Former Service"), viz. : - Seamanship, Navigation and Pilotage, Gunnery, Torpedo, and Engineering will be assessed at intervals of six months from commencement of time as Midshipman, and on leaving the ship, provided not less than three months have elapsed since the last assessment.

2. On becoming Acting Sub-Lieutenant the awards for seamanship and navigation will cease ; those for gunnery, torpedo and engineering will be continued until the officer passes in those subjects.

3. Should the date of assessment come before an officer has been three months in the ship, the award will be deferred until three months have expired.

4. The award will be made in marks, full marks being 100 in each subject. The award will be governed by the percentage of marks required for the different classes in the several examinations for the rank of Lieutenant, thus : -

In Seamanship, Navigation and Pilotage, Gunnery, and Torpedo						
First Class	-	-	-	-	-	-
Second "	-	-	-	-	-	-
Third "	-	-	-	-	-	-
In Engineering						
First Class	-	-	-	-	-	-
Second "	-	-	-	-	-	-
Third "	-	-	-	-	-	-

Regard is to be had throughout to the age and seniority of the officer.

5. Should it be considered that an officer is not up to the standard of efficiency of a third class, he may be given marks below that class.

6. When the officer presents himself for examination for the rank of Lieutenant the mean of all these awards, each subject being taken separately, will count in the examination in that subject as "Former Service."

7. These marks are to be in no way influenced by his conduct, but are to represent his Commanding Officer's opinion of his efficiency as an officer in the actual performance of his practical duties.

8. As it is impossible for the Commanding Officer to have personal knowledge of each officer's proficiency in all subjects, he is to take to his assistance in assessing the marks the officers responsible for each instruction, viz.:—the Executive, Navigating, Gunnery, Torpedo, and Engineer Officers.

RECORD OF EFFICIENCY.

Seamanship.

Ship.	Period of Service in Ship.	Number of Days in the Department during the Period.	Marks.	Signature of Executive Officer.	Captain's Initials.

Total Marks - - -

Mean - - -

Navigation and Pilotage.

Ship.	Period of Service in Ship.	Number of Days in the Department during the Period.	Marks.	Signature of Navigating Officer.	Captain's Initials.

Total Marks - - -

Mean - - -

Gunnery.

Ship.	Period of Service in Ship.	Number of Days in the Department during the Period.	Marks.	Signature of Lieutenant (G).	Captain's Initials.

Total Marks - - -

Mean - - -

Torpedo.

Ship.	Period of Service in Ship.	Number of Days in the Department during the Period.	Marks.	Signature of Lieutenant (T).	Captain's Initials.

Total Marks - - -

Mean - - -

Engineering

QUALIFYING CERTIFICATES.

Boats and Signals.

This is to certify that Mr. _____, Midshipman, has qualified in the following subjects:—

- (1) Handling of boats under oars and sail;
- (2) Handling of boats under steam;
- (3) Semaphore and Morse.

Captain, H.M.S. " " "
*H.M.S. " " "
*H.M.S. " " "

Date.

Engine Room Duties.

This is to certify that Mr. _____ has satisfactorily carried out the duties of :—

(a) Stoker Petty Officer of a Stokehold ;
 (b) Stoker Petty Officer of an Engine Room ;
 and that he has satisfactorily taken charge of :—
 (a) An Engine Room ;
 (b) All the Boiler Rooms.

Engineer Officer.

Approved.

Captain,
H.M.S. " "

Date.

Navigation Observations.

This is to certify that Mr. _____, Midshipman, has completed the prescribed list of observations, as specified in the King's Regulations, and that the books containing the worked-out observations have been sent to the Office of the Director of Naval Education for inspection.

First set sent in _____	Second set sent in _____
Navigating Officer _____	Navigating Officer _____
Captain _____	Captain _____
Date _____	Date _____

CERTIFICATE OF EXAMINATION IN SEAMANSHIP FOR THE RANK OF LIEUTENANT.

Mr. _____, Midshipman, having been examined in Seamanship by this Board for the rank of Lieutenant, and having produced the prescribed certificates, viz:—

- (1) Qualification in handling boats;
- (2) Qualification in Morse and Semaphore;

is declared to have sufficient knowledge to take charge, as Officer of the Watch on deck, of a ship of war at sea, and to perform satisfactorily such duties as may be

* Two Officers of the Military Branch.

required of an Officer of the rank of Lieutenant, and is hereby awarded a class certificate.

Signature.

Rank.

Date

Full Marks. Marks awarded.

Oral Examination:—

Rigging, &c.	-	-	-	-	75
Anchor work	-	-	-	-	125
Rule of Road	-	-	-	-	100
Officer of Watch duties	-	-	-	-	250
Organisation	-	-	-	-	150
Signals	-	-	-	-	150
Journal	-	-	-	-	50
Former service	-	-	-	-	100
			Total	-	1,000

For a First Class	-	-	850	marks.
„ Second „	-	-	650	„
„ Third „	-	-	500	„

CERTIFICATE OF EXAMINATION IN NAVIGATION AND PILOTAGE FOR THE RANK OF LIEUTENANT.

Mr. _____, Midshipman, having been examined in navigation and pilotage by this Board for the rank of Lieutenant, and having produced his work book and a certificate showing that he has completed the prescribed list of observations, is declared to have sufficient knowledge to navigate one of His Majesty's Ships, and is hereby awarded a _____ class certificate.

Signature.

Rank.

Date

Full Marks. Marks awarded.

Written Examination:—

Section I. reckoning and observations	-	275	425
Section II. Navigation, nautical astronomy, tides and compasses	-	150	

Oral Examination:—

Section III.

Chronometers	-	-	-	30	475
Winds and currents	-	-	-	30	
Use of charts and sailing directions	-	-	-	45	
Fixing positions and shaping courses	-	-	-	80	
Navigation in pilotage waters	-	-	-	50	

General systems of coast lights and buoys

-

40

Use of instruments, sounding machines, &c.

-

40

Tides and tide tables

-

50

Mooring Board, Battenberg Indicator and Grant's Manoeuvring Board

-

50

Compasses

-

60

Former Service

-

100

Total

-

1,000

For a First Class	-	-	850	marks.
„ Second „	-	-	650	„
„ Third „	-	-	500	„

CERTIFICATE OF EXAMINATION IN GUNNERY FOR THE RANK OF LIEUTENANT.

Mr. , Acting Sub-Lieutenant, having been examined in Gunnery by this Board for the rank of Lieutenant, is declared to be qualified to take charge of a turret or other quarters, and to perform such gunnery duties as may be required of an officer of the rank of Lieutenant.

Signature.

Rank.

Date

Oral Examination :—	Full Marks.	Marks awarded.
Duties of Officer of Quarters - - -	350	drill 175 remainder 175.
Fire control - - -	-	125
Hydraulics - - -	-	125
Maxim - - -	-	25
Ammunition - - -	-	50
Field Training - - -	-	100
Organisation - - -	-	125
Former Service - - -	-	100
Total - - -	<u>1,000</u>	
For a First Class - - -	850 marks.	
, Second „ - - -	650 „	
, Third „ - - -	500 „	

CERTIFICATE OF EXAMINATION IN TORPEDO FOR THE RANK OF LIEUTENANT.

Mr. , Acting Sub-Lieutenant, having been examined in Torpedo by this Board for the rank of Lieutenant, is declared to be qualified in the use and care of torpedo weapons on board ship, and to have a practical knowledge of electrical work and the electric appliances in use in the Service, and is hereby awarded a class certificate.

Signature.

Rank.

Date

Oral Examination :—	Full Marks.	Marks awarded.
Whitehead—Part I. - - -	-	200
Part II. - - -	-	200
Director - - -	-	100
Mining - - -	-	100
Electrical work - - -	-	300
Former Service - - -	-	100
Total - - -	<u>1,000</u>	
For a First Class - - -	850 marks.	
, Second „ - - -	650 „	
, Third „ - - -	500 „	

CERTIFICATE OF EXAMINATION IN ENGINEERING FOR THE RANK OF LIEUTENANT.

This is to certify that Mr. , Acting Sub-Lieutenant, having been examined by this Board for the rank of Lieutenant, is declared to have sufficient knowledge to take charge as Engineer Officer of the Watch in a ship of war at sea

under an experienced Engineer Officer, if necessary, and to perform satisfactorily such duties as may be required of a Junior Engineer Officer. He is hereby awarded a **Class Certificate.**

Signature.

Rank.

Date	Full Marks.	Marks awarded.
Engineering Note-Book	-	100
Written Examination	-	400
Oral Examination :—		
Main machinery	-	50
Boilers	-	50
Auxiliary machinery and steamboats	-	50
Duties of Engineer Officer of the Watch at sea and in harbour	-	90
Examinations, adjustments, repairs, and minor mishaps to machinery and boilers	-	160
Former Service	-	100
	<u>Total</u>	<u>1,000</u>
For a First Class	-	700 marks.
,, Second „	-	550 „
,, Third „	-	400 „

Enclosure No. 18 in *Third Report of Education Committee*, dated 13th September 1912.

REGULATIONS FOR THE TRAINING OF JUNIOR OFFICERS,
As proposed by the Committee.

1. On leaving the training cruiser Midshipmen will serve for a minimum period of two years and four months at sea in that rank, and will remain as far as possible in the same ship.
2. The Training of Midshipmen and acting Sub-Lieutenants in seagoing ships will be so directed as to give them a practical knowledge of Seamanship, Navigation and Pilotage, Gunnery, Torpedo, and Engineering, and generally to fit them to perform the duties of a Lieutenant.
3. The training will consist chiefly in taking part in the daily work of the ship, and will be supplemented by such lectures or formal instruction as may be necessary.
4. Under the general supervision of the Captain, who will regulate the details, the responsibility for the training and instruction will rest with the—
 - Executive Officer in Seamanship and deck duties,
 - Navigating Officer in Navigation and Pilotage,
 - Gunnery Officer in Gunnery,
 - Torpedo Officer in Torpedo,
 - Engineer Officer in Engineering.
5. Midshipmen are not to be employed on the ship's clerical work, such as writing up engineering, gunnery, and torpedo logs, or filling in returns.
6. The Midshipmen will be divided into three sections, of which two will be employed on deck, on navigation and pilotage, gunnery and torpedo duties, and one on engineering duties. The sections will change rounds not oftener than every two months.
7. The time will be so allotted that—
 - One-sixth will be devoted to deck duties,
 - “ “ “ “ pilotage duties,
 - “ “ “ “ gunnery “
 - “ “ “ “ torpedo “and one-third will be devoted to engineering duties. All those who cannot be usefully

employed by the Navigating, Gunnery, and Torpedo Officers will be at the disposal of the Executive Officer for deck duties, signals, boat work, mates of decks, &c.

8. To bracket deck duties with navigation and pilotage, and gunnery with torpedo duties, has been found to be a good arrangement.

9. Arrangements will be made as far as possible to enable *all* Midshipmen to be present at any lecture which they can attend together with advantage. The same principle will also be extended to special drills for the two sections which are not employed in the engine room.

10. The period during which each Midshipman or Acting Sub-Lieutenant is performing duties in each branch will be recorded in the Junior Officers' Certificate (Form E. 190). On the same form awards for ability as an officer in all branches—viz.:—seamanship, navigation and pilotage, gunnery, torpedo and engineering will be assessed at intervals of six months from commencement of time as Midshipman, and on leaving the ship, provided not less than three months have elapsed since the last assessment. Should the date of assessment come before an officer has been three months in the ship, the award will be deferred until three months have expired. The award will be made in marks, full marks being 100 in each subject. The award will be governed by the percentage of marks required for the different classes in the several examinations for the rank of Lieutenant, thus:—

In Seamanship, Navigation and Pilotage, Gunnery and Torpedo —

First Class	-	-	-	-	-	-	85 or more.
Second „	-	-	-	-	-	-	65 to 84 inclusive.
Third „	-	-	-	-	-	-	50 to 64 „

In Engineering—

First Class	-	-	-	-	-	-	70 or more.
Second „	-	-	-	-	-	-	55 to 69 inclusive.
Third „	-	-	-	-	-	-	40 to 54 „

Regard is to be had throughout to the age and seniority of the officer. Should it be considered that an officer is not up to the standard of efficiency of a third class, he may be given marks below that class.

11. When the Midshipman (or Acting Sub-Lieutenant) presents himself for examination for the rank of Lieutenant, the mean of all these awards, each subject being taken separately, will count in the examination in that subject as "Former Service." These marks are to be in no way influenced by his conduct, but are to represent his Commanding Officer's opinion of his efficiency as an officer in the actual performance of his practical duties. As it is impossible for the Commanding Officer to have personal knowledge of each officer's proficiency in all subjects, he is to take to his assistance in assessing the marks the officers responsible for each instruction, viz.:—the Executive, Navigating, Gunnery, Torpedo and Engineer Officers.

12. In Navigation Midshipmen will be required to put in practice what they have been already taught. When the ship is at sea Midshipmen not doing duty in the engine room will take daily observations, work the reckoning and fix the position of the ship. The sights are to be worked out in a book, which is to be inspected weekly by the Captain, and handed in to the Board of Examiners in Navigation and Pilotage when passing for the rank of Lieutenant.

13. On completing 12 months' service at sea, each Midshipman will send in a book containing one complete set of the observations specified in Clause 14. These observations are to be revised in red ink and initialled by the Navigating Officer as having been taken and worked by the Junior Officer. One month before his examination in Seamanship for the rank of Lieutenant, each Midshipman will send in a second book containing two complete sets of the specified observations (*see* Clause 14) similarly certified. On both occasions the books containing the worked observations will be forwarded for inspection to the Director of Naval Education, Royal Naval College, Greenwich, together with Form S. 431a, revised in accordance with Clause 14, showing the observations completed by each junior officer, certified by the Navigating Officer. No marks will be assigned in respect of these observations, but in the event of the observations being found to be incorrect or incomplete, the officer will be required to complete them before promotion to the rank of Lieutenant.

14. *List of Observations.*—(I.) To find the ship's position, by drawing position lines, from—

- (a) Two altitudes of the sun, one being on the meridian :
- (b) Two altitudes of the sun, one being near the meridian :
- (c) Two altitudes of the sun, neither being on or near the meridian :
- (d) One altitude of the sun and one of another celestial body, neither being on the meridian :
- (e) Two altitudes of celestial bodies other than the sun (preferably taken during twilight) at approximately the same time, neither being on the meridian :
- (f) An altitude of any celestial body and a bearing of a terrestrial object.

N.B.—Of the above observations, (b), (c) and (e) are to be worked out in two ways, the ship's place being fixed (i) by drawing position lines and also (ii) by the use of tables, without drawing the lines.

(II.) To find the error of chronometer from two sets of absolute altitudes of the sun taken about the same bearing east and west, or from absolute altitudes of stars east and west.

15. When necessary the Captain may tell off another officer to assist the Navigating Officer in seeing that the Midshipmen carry out Clauses 12, 13 and 14.

16. *Narigation and Pilotage.*—The sub-section taking Navigation and Pilotage duties will follow the orders given below :—

(I.) They should compile a note book, from lectures given them by the Navigating Officer, and from the handbook of Pilotage.

They should be encouraged to write these notes in their own words, after having attended a lecture or read up a subject in the Handbook.

(II.) In addition to compiling a note-book, they should—

- (a) Be present when chronometers are being wound and compared, and should themselves occasionally carry out this duty, under the direct supervision of the Navigating Officer :
- (b) Observe the method of correcting charts and sailing directions, and assist the Navigating Officer in getting out charts for correction and restoring them when corrected, in order to become familiar with the method of indexing :
- (c) Obtain daily (both in harbour and at sea) deviations of the compass, plotting the results on a curve, so as to deduce the deviations on points on which observations could not be obtained :
- (d) Be capable of stripping sounding machines and patent logs for examination and oiling, &c., and be instructed and practised in the adjustment of the sextant :
- (e) Accompany the Navigating Officer when taking observations for error of chronometer; taking their own sights, and comparing the results with his :
- (f) Be given to work out each day in harbour (if possible) a set of observations for ascertaining the ship's position, plotting their results on a chart, these observations being selected from those actually taken by the Navigating Officer and recorded in his work book.

At Sea.

(III.) They should keep the ship's reckoning on a separate chart, take sights at the same time as the Navigating Officer, constantly fix the ship's position by cross bearings when in sight of land, and carry out all the ordinary duties of navigation. The Navigating Officer should examine this chart, and compare it with his own.

In going in and out of harbour, they should if possible, work on a separate large scale plan or chart, laying down their own courses, taking bearings and noting leading marks, &c., so as to acquire practical experience in the methods of pilotage.

(IV.) They should be instructed in the method of taking soundings, after which they should take charge of the sounding party in turn, reporting the soundings to the Navigating Officer.

17. *Gunnery.*—The sub-section taking Gunnery duties will follow the orders given below :—

They should make themselves acquainted with the General Orders issued by the Gunnery Officer.

They should be so trained that they can be gradually brought to assist the Gunnery Officer in his work and be given some responsibility in the Department. They should keep note books in which are to be entered rough sketches, descriptions of parts of gun machinery, repairs, &c., or other work being done in the Gunnery Department.

They should, when sufficiently experienced, assist the Gunnery Officer in such duties as :—

- (I.) Training gunlayers, sightsetters and other special numbers, instructing Dials and clock operators, &c.;
- (II.) Testing and adjusting sights;
- (III.) Preparing to fire service, sub-calibre, and aiming tube ammunition;
- (IV.) Adjusting breech mechanisms and firing gear;
- (V.) Using, testing, and adjusting the Rangefinder.

They should make themselves thoroughly acquainted with the main hydraulic machinery of the turrets and look out for defects, such as leaks, &c., in the machinery and pipe service.

They should learn thoroughly the fire control organisation of their ships.

They should keep in touch with and assist the Gunnery Officer in all the work of his Department.

Lectures on Gunnery will be given as necessary by the Gunnery Officer.

18. *Torpedo*.—The sub-section taking torpedo duties will follow the orders given below :—

They should make themselves acquainted with the general orders issued by the Torpedo Officer.

They should enter in their Note Books rough sketches, descriptions of repairs, &c., carried out in the Torpedo Officer's Department.

They should be so trained that they can be gradually brought to assist the Torpedo Officer in his work and be given some responsibility in the Department.

Whilst employed on Torpedo Work.

(I.) They should part, test, adjust and assist in running torpedoes, and when sufficiently experienced, they should be held responsible by the Torpedo Officer for the care and maintenance of torpedoes and tubes.

- (II.) They should test gyroscopes.

Whilst employed on Electrical Work.

When sufficiently experienced they should be made responsible by the Torpedo Officer for :—

- (I.) The running, including running in parallel, of dynamos;
- (II.) The running of motors;
- (III.) Locating and repairing faults in all circuits.

They should be present when the searchlights are burning and should be trained in their use and adjustment.

They should start any important electrical machines required, and from time to time visit the motors in use and see that they are running properly.

They should assist the Torpedo Officer in controlling the men employed in his department, watch the progress of work and carry out any examinations or work required of them.

They should work the boat hoist and capstan, if electrical, whenever possible.

Lectures on Torpedo and Electrical work will be given as necessary by the Torpedo Officer.

19. *Engineering*.—The section taking Engineering duties will follow the orders given below :—

- (a) They will be regarded as members of the Engine Room Staff for the time being, and are not to be required to undertake extraneous duties.
- (b) Their training will consist chiefly in taking part in the daily engineering work of the ship under the supervision of the Engineer Officers, who are to arrange for supplementing this routine by such lectures as may be necessary.

- (e) Before joining the Fleet Midshipmen will have been instructed in most of the principles that are involved, as well as in the use of tools and the handling of engines.
- (d) Each officer will keep an Engineering Note Book with descriptions and detailed sketches of parts of machinery, and with accounts of any repairs he may witness together with the reasons for the repair. This book will be periodically signed and dated by the Engineer Officer and will be examined and valued by the Board of Examination when passing for the rank of Lieutenant.
- (e) During the time he is attached to the engine room he should make sufficient acquaintance with the accounts kept of the receipt and expenditure of stores, and with the engine room register and defect Lists, in order that he may obtain an insight into the business management of the department.
- (f) The Engineer Captain of each Fleet or Squadron will make himself acquainted generally with the engineering instruction given to officers on board the several ships by visits to those ships, and he will be responsible for recommendations on the subject to the Commander-in-Chief or Flag Officer in Command.

At Sea.

- (g) They will keep regular watch (with commissioned officers if possible), preferably in three watches, so that they may always work with their own watch of stokers. But during their first year Midshipmen keeping engineering watches will be excused from duty between the hours of 10 p.m. and 5 a.m.
- (h) They should begin by taking part in the routine, blowing down boilers, taking densities, making entries in the Engine Room register, handling engines, taking indicator diagrams, to be worked out when off watch, and looking after bearings, evaporators and auxiliary machinery. They should then do the duties of Stoker Petty Officer of the stokehold and of the engine room, and when efficient in these duties take charge of an engine room and finally of all boiler rooms. The fact that he has performed these duties is to be certified on the certificate in Form E. 190 revised.

In Harbour.

- (i) They will be detailed separately, or in groups of two as may be convenient, for the following duties :—
 - (I.) Senior Engineer's Assistant.
 - (II.) Boilers.
 - (III.) Outside machinery.
 - (IV.) Double bottoms.
 - (V.) Boats.

Two of these duties may be combined in case the number of Midshipmen is insufficient to provide one for each.

- (j) They will also take turns as Midshipman of the day to assist the Engineer Officer of the day. About three weeks should be spent on each duty, not more than three duties being attempted in a two-monthly period. During the Midshipman's time in each department he will be expected to acquire a good knowledge of it, learning where spare gear is kept, when tests are due and so forth. He should supervise the hands, attend to the cleanliness of the department, see valves worked and engines started and running, take notes of the work going on, and make sketches of pipe leads and details of machinery. The Midshipman of the boats should make frequent trips in the boats' engine rooms and stokeholds, report defects and see them made good.
- (k) When working as Senior Engineer's Assistant he is to have an opportunity of obtaining insight into the adjustment of main and auxiliary engines, and the executive duties and organisation of the department. He will write up the register and help in arranging the work of the hands.

- (l) The Midshipman of the Day will assist the Engineer Officer of the Day in all ordinary routine work, divisions, quarters, night rounds, &c. He should take charge of all minor operations such as starting, cleaning, and working evaporators, renewing filter cartridges, and finding leaks.
- (m) It is not expected that Midshipmen can at once undertake the supervision of Engine Room Artificers' work, but they should have as much opportunity as possible of gaining insight into it, so that with further sea experience they will be fitted to direct ordinary repair operations.
- (n) During General Quarters, Fire and Collision Quarters, &c., care is to be taken to instruct the Midshipmen in the duties of Engineer Officers on those occasions.
- (o) In case the ship does not spend enough time at sea to make all Midshipmen well acquainted with Engine Room watchkeeping without keeping the night watches, these may be kept. For the same reason it may be desirable to give Midshipmen a certain amount of auxiliary watchkeeping in harbour by making each in turn keep the morning (auxiliary) harbour watch, and in such cases they should be given complete charge as soon as possible.
- (p) Midshipmen should be enabled to take advantage of such opportunities as present themselves of seeing engineering operations in the Dockyards.
- (q) Such lectures in Engineering and Hull and Fittings as are necessary will be given by an Engineer Officer specially detailed by the Engineer Commander for this duty.
- (r) A specimen set of orders for the routine of Midshipmen's work in the Engine Room Department, which has been found to work satisfactorily, is attached for the general guidance of the Engineer Officer.

*Sub-Enclosure in Enclosure No. 18, in Report of Education Committee, dated
13 September 1912.*

SPECIAL ORDERS FOR JUNIOR OFFICERS.

ENGINEERING.

The Midshipmen are to be divided as follows : -

- One for the boiler rooms ;
- “ “ double bottoms ;
- “ all auxiliary machinery outside the engine room and stokeholds ;
- “ the general duties with the Senior Engineer Lieutenant ;
- “ the boats.

The Midshipmen are to be under the orders of the Engineer Officers of the departments to which they belong.

In cases where there are more than five Midshipmen, two should be detailed for the more important duties.

The Midshipmen will be told off for stations at General, Fire, and Collision Quarters, and will assist the Engineer Officers at Divisions and Evening Quarters.

Each Midshipman will be told off for a steaming watch of Stokers, and he is to learn the names of the men in his watch as early as possible. He is to assist the Officer of his division in mustering bags and hammocks.

The Midshipmen are to make themselves acquainted with the general orders issued by the Engineer Commander and the Senior Engineer Lieutenant.

The Midshipmen are to keep an engineering note-book for sketches of leads of piping and engine details, descriptions of parts of machinery, repairs, adjustments, or other work being done.

This note-book will be periodically initialised by the Engineer Officer, and will finally be examined and valued by the Engineering Examination Board for the rank of Lieutenant.

In Harbour.—The Midshipmen will take day's duty in turn, with the exception of the one with the Senior Engineer Lieutenant.

The ordinary working hours are from 7.30 a.m. to 1.0 p.m., but Midshipmen are to understand that they are available for duty at any time they are on board.

When he is employed in the engine room department each Midshipman is to make one rough sketch, or description of work or machinery every day, and this is to be brought to the office by 9 a.m. on the following morning for inspection by the Engineer Officer doing clerical duties.

At Sea. —The Midshipmen will work in three watches with their own steaming watch, except as laid down in para. 19 (g) of the "Regulations for the Training of Junior Officers." When entering or leaving harbour, lighting up, and similar work, the watch is to be kept.

When on watch, the junior Midshipmen are to assist the Engineer Officer in all his duties; see that every man is doing his work properly; feel bearings; see lubricating boxes are supplied with the correct oil; see circulators, condensers, &c. are in proper working condition; take densities; check revolutions; and start any auxiliary engines required. From time to time they are to work the engines, keep the revolutions, write up the register, take diagrams, and make good any leaks. In the boiler rooms they are to see the firing correctly carried out, and the fires cleaned at the correct times; check the water level, and blow through glasses; and measure the reserve feed water tanks and record temperatures for the register. From time to time they are to take the densities of, and blow down the boilers, &c.

The senior Midshipmen are to be placed in charge of a portion of the watch as soon as they are capable, starting with one engine-room.

When off watch, the engineering note-book is to be kept up, diagrams worked out, and evolutions and quarters with the stokers are to be attended.

The Midshipman of the afternoon watch is to write up the E.R.A.'s work book, unless he is employed below.

Midshipman of the Day. —The Midshipman of the day is to regard himself as entirely responsible (under the Engineer Officer of the day) for the proper performance of the auxiliary watchkeeping day and night, and all orders relative to this work will pass through him. He is to see that the routine of cleaning fires, tubes, filters, &c., is carried out. He is to put steam on important auxiliary engines which require to be started, and in the case of those outside the engine room he is to do this in conjunction with the Midshipman of that part of the ship. At all times he is to be on the look out for defects arising in the engines or boilers in use (such as a drop in steam pressure, loss of water, leaky glands, &c.) and he is to take immediate steps to remedy them, reporting to the Engineer Officer of the day if he is unable to cope with them himself. He is to take the densities of the auxiliary boilers and evaporators, and to test the feed water and the water made by the evaporators, between 6.0 a.m. and 7.30 a.m., and is to report the result to the Engineer Officer of the day.

He is to regard the proper carrying out of the auxiliary watch as his principal duty, and if on account of it he is unable to attend to his duties in connection with the E.R.A.'s or hands, he is to call on the Midshipmen with the senior Engineer Lieutenant to carry them out.

Whenever the hands commence work the Midshipman of the day is to ascertain from the different Petty Officers of the several departments whether all the men are present, and is to report to the Engineer Officer of the day.

For the remainder of the ordinary working hours he is to assist the Engineer Officer of his own department, but he is to be ready to carry out any duties in connection with the auxiliary watch at all times.

He is to take charge of any hands employed on general work, such as rigging coaling shutes, and of all hands from 6.0 a.m. to 7.30 a.m., and he is to be present in the machinery department between those times unless required for duty elsewhere.

He is to write up (under the superintendence of the Engineer Officer of the day) the work book of the E.R.A.'s and Mechanicians, &c.

He is to inspect the engine and boiler rooms and also the dynamo rooms once between the hours of 5.0 p.m. and 7.0 p.m., and is to report any irregularity that he may notice to the Engineer Officer of the day.

He is to go night rounds with the Engineer Officer of the day, and is to assist the Engineer Officer of the day in making out the rounds report for the Engineer Commander.

The Midshipman with the Senior Engineer Lieutenant is to assist this Officer in controlling the work of the department, and in arranging the work of the E.R.A.'s and hands.

While with the Senior Engineer Lieutenant he is to copy out a watch and station bill, and he is to assist in making out the lists for steaming, coaling, &c.

He is to inspect the whole of the controlling and telegraph shafting before going to sea. He is to assist the Artificer Engineer to connect up the steering gear, seeing himself that all clutches are properly connected; he is to report to the Engineer Commander when the gear is ready for trying, and to attend the Engineer Commander while it is being done.

Midshipmen of Departments. In conjunction with the Midshipman of the day the Midshipman of each department is to start any important auxiliary engine required in it, other than those used in the ordinary routine of the ship, and, when working properly, turn the engine over to a responsible man. From time to time he is to visit the engines in use, occasionally taking charge of them to see that they are working correctly.

He is to assist the Engineer Officer of the department in controlling the men employed in it, to watch the progress of the work, and is to carry out any examinations or work required of him.

He is to acquire all possible information of the leads of pipes and details of machinery in the department and is to make sketches of them.

Unless employed elsewhere he is to see the E.R.A.'s in his department started on their work, and is to report them correct or otherwise to the Senior Engineer Lieutenant. On turning to after breakfast or lunch (unless acting as Midshipman of the day) each Midshipman is to find out from the Officer of his department whether he is required for any purpose, and if not, he is to make notes or sketches as ordered.

On occasion the Midshipmen will be required to assist in the work of departments other than that to which they belong.

The Midshipman of the boats is to make a trip in each boat running at least once in two days. He is to work the boat hoist, if hydraulic power, whenever possible.

When entering or leaving harbour he is to put steam on the capstan engine, and is to stand by it while it is being worked. If on watch at the time, he is to arrange to be relieved.

The Midshipman of the double bottoms is to spend most of his time getting a knowledge of and sketching the pumping, flooding, and ventilating arrangements and the construction of the ship.

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Enclosure No. 19 in Third Report of Education Committee, dated 13 September 1912.

APPOINTMENT OF MIDSHIPMEN.

Circular Letter.

No. 37.

C.W. 15186-1911.

Admiralty, S.W., 6th December 1911.

My Lords Commissioners of the Admiralty have had under review the system of appointment of Midshipmen laid down in Circular Letter No. 25 of 10th May 1910.*

Experience has shown that the transfer of Midshipmen from one ship to another at the end of their first and second years' training, together with the normal changes of ship due to recommissioning, refit, &c., have resulted in the young Officers serving for so short a period in any one ship that their value as an integral part of the ship's complement and their training afloat are apt to be seriously prejudiced.

Accordingly, My Lords will endeavour to arrange for the Midshipmen to remain in the ships to which they are appointed until the end of the commission, or until they are due for examination for the rank of Lieutenant.

Midshipmen will be appointed to such ships as are allowed Midshipmen by complement, so far as the numbers permit, and all appointments will be made by the Admiralty. The procedure whereby appointments to "B" ships are made by Commanders-in-Chief will be discontinued. My Lords consider it desirable that Midshipmen should continue to be lent to the smaller Cruisers or Destroyers in small numbers and for short periods, and Commanders-in-Chief are authorised to make

* Art. 293 of the King's Regulations and Admiralty Instructions 1906 (page 125).

arrangements for this whenever a suitable opportunity arises. The Midshipmen should be lent only, and should return to their parent ships, and the total period in their three years' service during which they are so lent should not exceed three to four months.

By Command of Their Lordships,

W. GRAHAM GREENE.

*To all Commanders-in-Chief,
Captains, Commanders, and
Commanding Officers of
H.M. Ships and Vessels at
Home and Abroad.*

Enclosure No. 20 in Third Report of Education Committee, dated 13 September 1912.

EXTRACT FROM THE ADDENDA OF 1911 TO THE KING'S REGULATIONS AND
ADMIRALTY INSTRUCTIONS OF 1906.

Annual Examination of Junior Officers afloat.

294A. An examination of all Midshipmen, serving in His Majesty's Fleet, will be held once a year, to commence on the first Monday in November.

2. The examination papers will be transmitted to the Fleet from the Admiralty. They are to be set in the following order, taking 2½ hours each:—

Paper 1.—Monday	- Morning	- Seamanship I.
„ 2. „ „	- Afternoon	- „ II.
„ 3. „ Tuesday	- Morning	- Navigation I.
„ 4. „ „	- Afternoon	- „ II.
„ 5. „ Wednesday	- Morning	- Gunnery I.
„ 6. „ „	- Afternoon	- „ II.
„ 7. „ Thursday	- Morning	- Torpedo I.
„ 8. „ „	- Afternoon	- „ II.
„ 9. „ Friday	- Morning	- Engineering I.
„ 10. „ „	- Afternoon	- „ II.

3. Whenever practicable, arrangements are to be made for the examination to be carried out on shore in a suitable hall. In all cases, whether the examination is held on shore or afloat, strict supervision is to be exercised by an Officer of the Military Branch, detailed for the purpose, and precautions are to be taken to prevent the Midshipmen from having any assistance from one another or from other persons.

The supervising Officer is to be given such assistance as may be necessary to ensure continuous invigilation of all Midshipmen under examination.

When the Midshipmen from several ships are examined together on shore the Officer detailed to supervise the examination is not to be under the rank of Commander.

4. The seal of the envelope enclosing each paper of questions is to be broken in the presence of the Officers to be examined when they are assembled for the examination.

5. An Index number is to be assigned to each Officer examined. The Officer's number, his name in full, and the name of his ship are to be written on every paper.

6. The paper used for the examination should be of foolscap size, and should be written upon only on one side. The worked papers in each subject are to be made up in a separate parcel without being folded, and are to be arranged according to the numerical sequence of the index numbers. In case any Officer is absent from any part of the examination, a sheet of paper bearing his name and index number and stating the reason of his absence, is to be inserted in place of the missing paper. Care should be taken that the name of the ship to which the papers belong, the subject of examination, and the number of Officers examined are plainly indicated on the cover. *See 1411 (Stationery for Examinations).*

7. No books are to be allowed during the examination, except tables of logarithms and the Nautical Almanac. (Tables of logarithms bound up with a treatise of navigation are not to be used.)

8. The worked papers are to be sealed up and sent direct to Director of Naval Education, Royal Naval College, Greenwich, with the least possible delay, immediately the examination is over. Form S. 395 is to be filled in and forwarded separately not later than the first day of the examination.

9. Should any emergency arise, such as "stress of weather," so as to interfere with the authorised days, the examination is to be held as soon after as circumstances permit, and the Captain or the Senior Officer present is to report the full circumstances of the case for the information of the Admiralty.

10. Should the result of an Officer's yearly examination be unsatisfactory, he will be liable to the loss of one month's time.

Extract from Admiralty Weekly Orders, 1911.

241. -ANNUAL EXAMINATION OF JUNIOR OFFICERS ALLOAT.

(C.W. 12305.—18.1911.)

With reference to Article **294A** of the King's Regulations and Admiralty Instructions, it has been decided, in view of the fact that the annual examination alloat now deals exclusively with professional subjects, that papers shall not in future be sent out from the Admiralty, but that the examination shall be conducted locally.

The Commanders-in-Chief of the Fleets carrying Midshipmen are therefore to detail Officers to carry out the examination, and are to make all necessary arrangements, reporting the results to the Admiralty.

The dates, subjects and general scope of the examination are to remain as under the existing regulations.

Enclosure No. 21 in Third Report of Education Committee, dated 13 September 1912.

COURSES TO BE TAKEN PRIOR TO PASSING FOR THE RANK OF LIEUTENANT.

In the year 1902.

Subsequent to 1906.

Royal Naval College, Greenwich —
Part I. 2 months.
Part II. 3 months.

Royal Naval College, Greenwich
Part II. six months only for those
Officers who do well in Part I. No course
for Part I.)

Portsmouth —
Gunnery 13 weeks.
Torpedo 5 „
Greenwich —
Pilotage 6 „

Portsmouth —
Gunnery 12 weeks.
Torpedo 6 „
Pilotage 6 „

Enclosure No. 22 in Third Report of Education Committee, dated 13 September 1912.

EXAMINATIONS FOR THE RANK OF LIEUTENANT (NEW SCHEME).

(Circular Letter, No. 51, of 1st May 1908.)

C.W. 3010.

Admiralty, March 1911.

My Lords Commissioners of the Admiralty have approved of the following arrangements in connection with the forthcoming examinations for the rank of Lieutenant under the new scheme.

The examination will commence on Monday, 15th May, and the written portion will be held in the gymnasium of the Navigation School, Portsmouth, in which establishment the Midshipmen will be accommodated.

PROGRAMME OF WRITTEN EXAMINATION.

			9 to 12.	1.30 to 4.30.
Monday	-	-	Navigation I.	Navigation II.
Tuesday	-	-	“ III.	“ IV.
Wednesday	-	-	Seamanship I.	Seamanship II.
Thursday	-	-	Gunnery I.	Gunnery II.
Friday	-	-	Torpedo I.	Torpedo II.
Saturday	-	-	Engineering I.	Engineering II.

ORAL EXAMINATION.

The oral part will commence on Monday, 22nd May. For this portion of the examination the Midshipmen will be divided into five groups, and the examination will proceed as shown in the following table :—

		Seamanship.	Navigation.	Gunnery.	Torpedo.
Monday	-	1	2	3 4	5
Tuesday	-	5	1	2 3	4
Wednesday	-	4	5	1 2	3
Thursday	-	3	4	5 1	2
Friday	-	2	3	4 5	1

The oral examinations in Gunnery and Torpedo will be held at Whale Island and on board H.M.S. "Vernon," respectively. The oral examination in Seamanship will be held as may be arranged by the Commander-in-Chief at Portsmouth.

At the conclusion of the oral examinations the Midshipmen will go on leave.

VOLUNTARY PART.

This part of the examination will begin on the 5th June.

In the absence of notice to the contrary Midshipmen who wish to take voluntary subjects will return to the Navigation School in time to sit for their papers.

In the present instance the examination in these subjects commences at 9 a.m. on Monday, the 5th of June.

The voluntary part consists of written papers only, except that candidates for the Ryder Prize will be examined orally in French, and candidates in Naval History may have an oral examination on the essays they have submitted.

PROGRAMME OF VOLUNTARY PART.

		9 to 12.	1.30 to 4.30.
Monday	-	Practical Mathematics.	French.
Tuesday	-	Mechanics and Heat.	Oral French and Oral Naval History.
Wednesday	-	Electricity.	Do.
Thursday	-	Other Foreign Languages.	—

A list of the Midshipmen due to attend the examinations for the rank of Lieutenant, commencing on 15th May, is attached. While undergoing the examinations they will be borne on the books of H.M.S. "Dryad."

By Command of their Lordships,

C. I. THOMAS.

Enclosure No. 23 in Third Report of Education Committee, dated 13 September 1912.

EXTRACTS FROM ADMIRALTY WEEKLY ORDERS, 1911.

246.—EXAMINATION FOR RANK OF LIEUTENANT.

(C.W. 12,263.—18.1911.)

The following arrangements have been approved in regard to the examination for the rank of Lieutenant to be held in September next.

The compulsory part will be held from the 18th to the 29th September, and the voluntary part from the 3rd to the 6th October, all inclusive.

The examination in Navigation will be according to the following syllabus, and will be reduced to one day. As this will save a day's time in the written part of the compulsory examination, the Wednesday and Saturday afternoons will be left free.

A revised syllabus in Engineering is given below.

Revised syllabuses of the Gunnery and Torpedo examinations will be issued in due course.

All Midshipmen may enter for the voluntary part, but attention is called to the regulation that Officers who do so must take up two subjects, and not more than three.

Time-tables of the examination are being printed, and will be issued in due course.

SUBJECTS OF EXAMINATION FOR THE RANK OF LIEUTENANT.

II.—NAVIGATION AND PILOTAGE.

Text-books.

1. Modern Navigation, by Rev. W. Hall, R.N.

2. Handbook of Pilotage.

(Every Midshipman is expected to provide himself with a copy of this Handbook, which may be obtained from the Paymaster of the ship in which he is serving. Price 2s.)

Note.—These books indicate the amount of each subject the candidates are expected to know, but much useful information can be obtained from other books and also from the Admiralty publications.

SECTION I.

Reckoning and Observations.

One Paper.	Working out the dead reckoning of a ship	-	-	-	-	300 marks.
	Fixing a ship's position by plotting position lines	-	-	-	-	
	Fixing a ship's position from two observations without plotting, using traverse and other tables	-	-	-	-	
	Error of chronometer from two sets of absolute altitudes of the sun taken about the same bearing east and west, or from absolute altitudes of stars east and west	-	-	-	-	

SECTION II.

(a) *Theoretical Navigation and Nautical Astronomy.*
 (b) *Tides.*
 (c) *Compasses.*

(a) <i>Navigation and Nautical Astronomy.</i>	—110 marks.
Explanation of terms in ordinary use, the earth being regarded as a sphere	- - - - -
Plane, parallel, and middle latitude sailing	- - - - -
Construction of Mercator's chart and table of meridional parts. Mercator's sailing	- - - - -
General principles of the construction of great circle and polar charts	- - - - -
Great circle and composite sailing	- - - - -
Plotting approximate great circle and composite tracks on a Mercator's chart	- - - - -
Theory and use of the sextant, vernier, artificial horizon, and station pointer	- - - - -
The projection of a sphere on the planes of the horizon and of the equator	- - - - -
Meaning and use of the acceleration table	- - - - -
Calculating time of meridian passage of a body	- - - - -
Finding what bodies pass the meridian between two given times and which are suitable for observation	- - - - -

One paper.	Explanation without proofs of effects of dip, refraction and parallax on observations of altitude	- - - - -	200 marks.
	Approximate times of rising and setting of the sun and moon	- - - - -	
	Calculation of the zenith distance of a heavenly body	- - - - -	
	Finding the true bearing of a heavenly body, having given the time or the altitude of the body	- - - - -	
	Knowledge of how to use azimuth tables	- - - - -	
	Methods of obtaining the compass deviation	- - - - -	
	Latitude by meridian altitude, or altitude of Pole Star	- - - - -	
	Explanation of how to find a position line from the altitude of a heavenly body and the G.M.T.	- - - - -	
	The uses of a single position line. The choice of bodies for fixing by a cut	- - - - -	
	Choice of celestial bodies for finding error of chronometer	- - - - -	
Examples connected with error and rate of chronometer, other than those in Section I.			
NOTE to (b) Tides and (c) Compasses.—The questions in this paper will be limited to those which can be more conveniently dealt with on paper than by oral examination. Further questions on both subjects may be expected in the oral examination			
(b) <i>Tides</i> .—25 marks.			
Elementary explanation of the causes of the tides and of the phases of the moon			
Calculation of times of high and low water at a given place by means of approximate rules			
Calculation of the depth of water at a certain place for any state of the tide (a) by means of tables (b) by means of harmonic motion diagram			
(c) <i>Compasses</i> .—35 marks.			
Terrestrial magnetism and the laws of induction			
The magnetism of ships and its liability to change			
Semicircular, quadrantal and heeling error; and the principles of the mechanical correction			
To adjust a ship for B, C, D			
To swing ship and analyse the deviation table, finding the approximate co-efficients			

SECTION III.

Oral Part.

500 marks.	Management and care of chronometers, stowage and safe distances from electrical appliances. To compare and take times accurately. The value of the several methods of rating chronometers, and the means adopted for the elimination of errors	- - - - -	
	General knowledge of the principal prevailing winds and currents of the globe, and of the principal routes adopted in making passages. The laws of revolving storms	- - - - -	
	A more detailed knowledge of the winds and currents prevalent on the stations on which each Midshipman has served	- - - - -	
	Knowledge of duties of Navigating Officer, <i>vide</i> "King's Regulations," and "Notes bearing on the Navigation of H.M. Ships"	- - - - -	
	Practical use of charts and sailing directions, and of the various books, tables, &c., supplied with the chart boxes. Fixing positions by all methods, including the station pointer. Shaping courses and allowing for tides and currents	- - - - -	
	Principles of navigation in pilotage waters, use of leading marks, clearing marks, danger angles, and of lines of bearing to avoid dangers. To anchor a vessel in a pre-arranged	- - - - -	

position on a chart. Precautions when navigating in a fog, and method of utilising soundings	-	-	-	-	-
General systems of lighting, buoyage, and fog-signals in use on the coast of the British Islands	-	-	-	-	-
Practical use and management of meteorological instruments, sounding machines, patent logs, and other navigating appliances, and the practical adjustment of the sextant	-	-	-	-	-
Knowledge of tidal laws. Practical use of Admiralty tide tables and tidal atlases. Definitions and explanations of terms used in connection with tides	-	-	-	-	-
The mooring board and the Battenberg indicator	-	-	-	-	-
Making an amendment to a chart	-	-	-	-	-
Knowledge of the characteristics and the management of the various compasses and their appliances as supplied to H.M. Ships. The practical correction of a compass	-	-	-	-	-
Further questions on Section II. (c)	-	-	-	-	-
Total	-	-	-	-	1,000

V.—ENGINEERING.

The examination will be mainly on the subjects named below, but will also include a few questions on the general theoretical principles of marine engineering which the officers have studied during their training as Cadets, such as the most elementary thermodynamics of heat engines, the laws of gases, the physical properties of steam, combustion, the use of the indicator, the nature of the resistance to propulsion, and the relation of power to speed in ships.

Main Engines.—Modern forms of direct-acting propelling engines, functions of each part and details of the construction of the important pieces, such as cylinders, pistons, slide-valves, link-motions, important bearings and glands, condensers, air-pumps, framing, adjustments for moving parts.

Turbines.—Parsons type; function of parts; details of construction of the important parts, such as rotors, stators or casings, blading, glands, thrust blocks, dummy pistons, couplings; average clearances allowed; general arrangements in ships; advantages and disadvantages over the direct-acting engine.

Internal Combustion Engines.—Functions of parts and details of parts peculiar to the engine, such as vapourisers, governing gear, igniters, oil-supply pumps, air and exhaust valves, starting arrangements; advantages and disadvantages over steam engines.

Boilers.—Details of construction of the parts under pressure, casings and supports of cylindrical, Belleville, Babcock and Wilcox, and Yarrow large tube boilers; and Thornycroft, Yarrow, White Forster, Normand small tube boilers. Details of important boiler mountings, such as stop valves, safety valves, gauge glasses, feed regulators.

General Arrangements of main and auxiliary steam and exhaust leads of pipes and valves feed system, including evaporators and distillers with the drinking water connections; details of construction of main and auxiliary feed pumps, evaporators, fire and bilge pumps, blowing engines, fans and all auxiliary engines in engine and boiler rooms.

Auxiliary Machinery.—Hydraulic installation; general arrangement of pipes and valves for distributing power; detail of the pump and engine; governing devices; details of pipe jointing.

Refrigerating Plant.—Types used; elementary principles of action. Principal details of dry air, carbonic acid and ammonia refrigerating machinery. Brine circulation. Arrangements for cooling magazines.

Electric Installation.—Types of engine used; detail of governor to provide for searchlight practice; use of oil engines; advantage over steam engines; details of parts peculiar to engine.

Air Compressing Plant.—Types of air compressors used and details of pumps; details of packing, air-cooling and lubrication; general arrangement of air leads and details of separator columns and storage reservoirs; pipe jointings.

Capstan Gear.—Type of engine; general arrangement of the plant; detail of differential valve, hauling and veering clutches; cable holders.

Steering Gear.—General arrangement of plant from rudder head to engine; detail of differential valve and hunting gear.

Miscellaneous.—A detail knowledge of engine-room telegraphs; centering devices; steering engine and telegraph control shafting; means of changing position of control; detail of lubricating arrangements for all engines; coaling gear; transporters; oil fuel burning and conditions required for good stoking.

Ship Construction.—Materials used in construction, and where used; tests of materials; comparison of a ship to a loaded beam; metacentric height; angle of heel and trim due to change of distribution of weight; stability; tons per inch immersion; general knowledge (not detail dimensions) of the construction of the plating of hull; beams, longitudinal and transverse framing; watertight divisions of ships and means of access, doors and hatches; armour position and attachment; protective decks; engine and boiler bearers and staying; stem, stern and A frames; stern tube fittings; coal bunker arrangements and coaling fittings, pumping, flooding, and drainage arrangements of the hull generally; ventilation systems. Steering arrangements; types of rudders.

258. EXAMINATION FOR RANK OF LIEUTENANT.

(C.W.—18.8.1911.)

With reference to Weekly Order No. 246 of the 4th instant, the syllabus in Torpedo at the forthcoming examination of Midshipmen for the rank of Lieutenant will be as follows:—

IV. TORPEDO.

The examination will aim at finding out the knowledge of the young Officer with regard to the care and preparation of Torpedo weapons on board ship in peace time and their use in War, together with a practical knowledge of electricity and the electrical appliances in use in the Service. They should not be required to commit to memory detailed sketches or tables of weights and dimensions.

The questions on Current and Power should consist of those the Officers would be likely to need and come across at sea as a Lieutenant.

A.—Whitehead.

- (1) The utility and powers of a torpedo; where and when it is likely to be used.
- (2) The general description of the principal parts including the gyroscope, servomotors, and fittings in any type of ship in which the Officer has served.
- (3) The care and maintenance of torpedoes.
- (4) The existing methods of carrying out Fleet Torpedo practice.
- (5) The tests made before running.
- (6) The preparation of torpedoes for use in action from a ship or a torpedo craft.
- (7) The director; its description and use.
- (8) The pistol and net cutter; how fitted, tested, and stowed.
- (9) The general description of submerged and above water torpedo tubes and their fittings. Angles of training in vessels served in.
- (10) Air pumps and air service.
- (11) Duties of numbers and drill at the tubes and dropping gear without detail.

B.—Mining.

- (1) Methods of offensive mining.
- (2) The spherical mine and its fittings (general but not a detailed knowledge).
- (3) Methods of clearing a mine field.
- (4) Explosives, with general knowledge of those in use in the Service, their stowage and testing.
- (5) Demolition of booms, wrecks, and buildings.

C.—Practical Electricity and Electrical Appliances.

- (1) Cells and batteries commonly used in the Service, their action and characteristics; general principles of the electric circuit.

- (2) Elementary theory of dynamos and motors and general principles of their construction. Types of dynamos and motors with which they are acquainted.
- (3) General description of motor controllers and starters.
- (4) Care and maintenance of electric machines and simple tests of the same.
- (5) The use of switchboards and instruments. Distribution of electric power in ships.
- (6) Systems of electric lighting. Testing for faults.
- (7) Searchlights. Principle of the automatic searchlight lamp and how to use it practically. Control of searchlights.
- (8) Arc lights. General description of lamps supplied.
- (9) Telephones and electric bells.
- (10) Gun circuits and night sights.
- (11) Elementary notions of Wireless Telegraphy. Sending and receiving apparatus.

270.—EXAMINATION FOR RANK OF LIEUTENANT.

(C.W.—1.9.1911.)

With reference to Weekly Order No. 246 of the 4th August 1911, the Syllabus in Gunnery at the forthcoming examinations for the rank of Lieutenant will be as follows:—

III.

Gunnery.

This examination, except where otherwise specified, is to include only the guns and machinery of the ships in which the Officer has served. Special regard is to be paid to making it a test of an Officer's fitness to take charge of guns and men, and anything in the nature of the committal to memory of detailed drawings or tables of figures is to be avoided.

I.

Stripping.—To be able to strip, assemble, and adjust all the parts of one selected hand-worked gun and mounting.

To be able to describe the method of stripping and examining all the principal machinery of a 12" turret, the probable causes of breakdowns and the remedies.

A thorough knowledge of leads and contacts of gun circuits and tests for the same. Also the safety arrangements of guns.

A good knowledge of the sighting arrangements, and the method of altering the sight dials when necessary.

Gun Drill.—To perform the duties of any number; to drill and instruct a gun's crew at a gun of any type carried in the ships in which he has served.

Turret Gun Drill.—To perform the duties of any number; to drill and instruct a turret crew; to answer questions on the machinery and fitting.

Ammunition.

Projectiles.—Nature supplied to ship, stowage, method of lifting and traversing, driving bands.

Fuzes.—Knowledge of different kinds of fuzes used, how fitted and stowage, ability to sketch, shell room ventilation, flooding, draining, &c.

Cordite.—Primers, heat test.

Magazine.—General arrangement, method of keeping temperature, lot numbers, order of using, &c.

Embarking Ammunition.—Methods used in ships served in. Precautions to be taken.

Field Training.—To be able to take charge of a company at drill and firing exercise, and knowledge of how to take a company through the range.

Hydraulics.—A complete knowledge of one 12" mounting. To be able to describe all the hydraulic machinery of the selected turret.

Organisation.—To have a complete knowledge of all to do with—

Internal organisation for war and battle.

Organisation of fire control by day.

Organisation of night defence control.

* * * * *

Enclosure No. 21 in Third Report of Education Committee, dated 13th September 1912.

EXAMINATIONS IN SEAMANSHIP AND NAVIGATION FOR RANK OF LIEUTENANT TO BE
HELD AFLOAT.

MIDSHIPMEN to be rated ACTING SUB-LIEUTENANTS ON PASSING.

Circular Letter.

No. 11.

C.W. 8524.

Admiralty, S.W., 30th April 1912.

My Lords Commissioners of the Admiralty, having under their consideration the system of training Junior Officers, have approved provisionally, pending the issue of further instructions, of the regulations being modified so as to enable Midshipmen to attain the rank of Acting Sub-Lieutenant at an earlier age than at present, with a view to their employment on more responsible duties during the latter part of their training afloat.

In accordance with this modification Midshipmen will be examined at sea in Seamanship and Navigation when they have completed two years and four months' seniority, and, on passing, they will be rated Acting Sub-Lieutenants. They will remain in the same ship, but, while continuing their training in the several special branches, will be given more responsibility, thus beginning earlier to qualify for the duties of a Lieutenant, Officer of the Watch, and Officer of Quarters and Divisions, &c.

On completing three years at sea they will be examined at Portsmouth in the remaining four subjects of the examination for the rank of Lieutenant.

Candidates who fail in either or both of the two subjects in the examinations afloat will be put back for four months, and will then be re-examined in the subject or subjects in which they failed. They will not become Acting Sub-Lieutenants until they have passed, but failure on the first occasion will not entail any other penalty except that those who obtain first or second class certificates at the second trial will not count marks for those certificates towards accelerated promotion. A second failure will render an Officer liable to discharge from the Service. A Midshipman who is put back will still present himself with his term four months later at Portsmouth for examination in other subjects.

The certificates to be granted to Midshipmen on passing in Seamanship and Navigation are attached. A supply of these certificates will be issued in due course. The certificates are to be filled up in duplicate, one copy being handed to the Officer and the other forwarded to the Admiralty for purposes of record.

With reference to Article **293A**, clause 23, of the King's Regulations, Addenda 1911, the second set of observations required is to be sent in one month before a Midshipman is due for examination at sea instead of after two years and six months' service as at present.

The new arrangement will come into force for the first time in September next, when the Midshipmen of seniority January 1910 and May 1910 will be examined together. The Midshipmen of seniority September 1909 will take the whole examination at Portsmouth under the existing conditions at the same time.

The examinations in Seamanship and Navigation will be conducted by Boards of Examiners who are to be appointed in each Fleet by the Commander-in-Chief. The details of the arrangements to be made for each examination are given in the Appendix attached to this letter.

My Lords particularly impress upon Commanding Officers the importance of ensuring that, during the four months immediately preceding the examination afloat, Midshipmen are engaged in the training laid down for Branches I. and II. in clause 11 of Article **293A** of the King's Regulations and Admiralty Instructions; and that after the examination, when they become Acting Sub-

Lieutenants, the routine of training is continued, being so adjusted that the training in Branch III. (Engineering) shall not suffer through the above provision.

By Command of Their Lordships,

W. GRAHAM GREENE.

*To all Commanders-in-Chief,
Captains, Commanders
and Commanding Officers
of H.M. Ships and Vessels
at Home and Abroad.*

APPENDIX.

EXAMINATIONS IN SEAMANSHIP AND NAVIGATION FOR THE RANK OF LIEUTENANT.

Navigation (including Pilotage).

The Board of Examiners in Navigation is to consist, in each Fleet, of three or more Officers who have specialised in Navigation, under the presidency of a Captain.

The examination is to consist of two written papers and an oral part, and is to commence on the second Tuesday in January, May, and September, when the written papers will be taken, one in the morning and the other in the afternoon. The oral part is to follow the written part.

The question papers will be set by the Commanding Officer of the Navigation School, Portsmouth, who will send the questions under seal to the Director of Naval Education for printing three months before the date of the examination. The printed question papers will be circulated to the Fleets from the Admiralty in sealed packages, which are to be opened in the presence of the candidates assembled for the written part of the examination.

The written part of the examination is to be carried out in a room on shore whenever this is practicable; the Board of Examiners being held responsible for adequate supervision. A report is to be furnished as to the place in which the examination has been held and the arrangements for supervision.

The worked papers are to be marked by the Examining Board, and sent to the Admiralty after marking.

Marks to a total of 1,000 are to be assigned by the Board, including 500 for the written part of the examination. The distribution of marks is to agree generally with the existing schedule.

The Board is to award classes on the basis of 750 for a First Class, 650 for a Second Class, and 450 for a Third Class. The marks and classes awarded are to be reported to the Admiralty.

Seamanship.

The Board of Examiners in Seamanship is to consist, in each Fleet, of three or more Officers not below the rank of Commander, of whom one at least shall be a Captain.

The Board is to carry out the whole examination, which will be entirely oral. The examination is to take place concurrently with the oral examination in Navigation.

Marks to the total of 1,000 are to be assigned by the Board, including 100 for the Journal and 50 for former service; the distribution of marks to agree generally with the existing schedule.

The Board is to award classes on the basis of 850 marks for a First Class, 700 marks for a Second Class, and 600 marks for a Third Class; the marks and classes awarded being reported to the Admiralty.

Candidates who are declared by the respective Boards to have passed in Navigation and in Seamanship will forthwith become Acting Sub-Lieutenants.

Payment for marking the papers will be made at the rate of 1s. 6d. per candidate for each paper.

Certificate of Examination in Seamanship for the Rank of Lieutenant.

This is to certify that Mr. _____, Midshipman, on presenting himself for examination in Seamanship, has produced the prescribed qualifying certificates, namely:—

- (1) Certificate of Qualification in Handling Boats and in Signals.
- (2) Certificate showing that he has completed the prescribed lists of Observations.

Having been examined by this Board he is declared to have qualified in Seamanship for the rank of Lieutenant and is hereby awarded a _____ Class Certificate.

Signed {

Captain, H.M.S. " _____"
President of the Board for Examination in Seamanship.

Date.

Syllabus of Examination in Seamanship.

						Maximum Marks.	Marks Awarded.
FORMER SERVICE	-	(See King's Regulations, Art. 293A, Clause 9)	-	-	-	50	
JOURNAL	-	Neatness and quality of information	-	-	-	50	
		Plans, sketches, mechanical drawings	-	-	-	50	100
RIGGING	-	Fitting of rigging, preservation of rigging, hawsers, boat falls; tackles, strength of ropes, chains, &c., fittings of torpedo nets	-	-	-	75	
		Sheers and derricks	-	-	-	50	250
ANCHOR WORK	-	Working anchors and cables	-	-	-	100	
		Fittings in connection with	-	-	-	25	
OFFICER OF WATCH AND RULE OF ROAD.	-	Duties of Officer of Watch	-	-	-	100	
		Rule of the road at sea	-	-	-	100	
		Towing, &c., rudder and screw	-	-	-	25	300
		Knowledge of seamanlike work	-	-	-	75	
ORGANISATION	-	Internal economy	-	-	-	75	
		Stationing of a ship's company	-	-	-	100	
		Organisation of fleet	-	-	-	75	300
SIGNALS	-	Signal books	-	-	-	50	
					Total	-	1,000

For a First Class, 850 marks.
" Second Class, 700 marks.
" Third Class, 600 marks.

Certificate of Examination in Navigation and Pilotage for the Rank of Lieutenant.

This is to certify that Mr. _____, Midshipman, having been examined by this Board, is declared to have qualified in Navigation and Pilotage for the rank of Lieutenant, and is hereby awarded a _____ Class Certificate.

Signed } _____

Captain H.M.S. " _____
President of the Board of Examiners
in Navigation and Pilotage.

Date.

						Full Marks.	Marks Awarded.
<i>Written Examination:</i> —							
Paper I.	Reckoning and observations	-	-	-	-	300	
Paper II.	Theoretical navigation and nautical astronomy: tides and compasses	-	-	-	-	200	500
<i>Oral Examination:</i> —							
Chronometers	-	-	-	-	-	10	
Winds and currents	-	-	-	-	-	40	
Use of charts and Sailing Directions	-	-	-	-	-	50	
Fixing positions and shaping courses	-	-	-	-	-	80	
Navigation in pilotage waters	-	-	-	-	-	50	500
General systems of coast lights and buoys	-	-	-	-	-	10	
Use of instruments, sounding machines, &c.	-	-	-	-	-	40	
Tides and tide tables	-	-	-	-	-	50	
Mooring board and Battenberg indicator	-	-	-	-	-	50	
Compasses	-	-	-	-	-	60	
					Total	-	1,000

For a First Class, 750 marks.
" Second Class, 650 marks.
" Third Class, 450 marks.

Enclosure No. 25 in Third Report of Education Committee, dated 13th September 1912.

REGULATIONS TO GOVERN THE EXAMINATIONS FOR THE RANK OF LIEUTENANT,
as proposed by the Committee.

1. All examinations will take place at sea.

Midshipmen will be examined for the rank of Lieutenant in Seamanship and Navigation when they have completed two years and four months at sea, and on passing they will be rated Acting Sub-Lieutenants. After the examination in Seamanship and Navigation, when the Midshipmen become Acting Sub-Lieutenants, the routine of training is to be continued, being so adjusted that the training in Engineering shall not suffer.

2. On completing two years and 10 months at sea they will be examined in Gunnery, Torpedo and Engineering.

3. Midshipmen on presenting themselves for examination in Seamanship and Navigation must produce the following documents :—

(a) Form E. 190 revised, including the following certificates :—

- I. Naval Cadet's Passing-Out Certificate.
- II. Record of Efficiency in Seamanship and Navigation ("former service").
- III. Qualifying Certificate in Boats and Signals.
- IV. Qualifying Certificate of Navigation Observations.

(b) The Journal kept in accordance with Article **296A**, K.R. and A.I.

4. Acting Sub-Lieutenants on presenting themselves for examination in Gunnery, Torpedo and Engineering, must produce the following documents :—

(a) Form E. 190 revised, including the following certificates :—

Record of efficiency in Engineering, Gunnery and Torpedo ("former service").

(b) Engineering Note-book.

(c) Qualifying certificate in engine-room duties.

5. The Board of Examiners in each Fleet are to be composed as follows :—

Seamanship	-	-	A Captain.
			Two Officers not below the rank of Commander.
Navigation	-	-	A Captain.
			Two Navigating Officers.
Engineering	-	-	A Captain.
			Two Engineer Officers.
Gunnery	-	-	A Captain.
			A Lieutenant (G.).
			One other Officer (Commander or Lieutenant).
Torpedo	-	-	A Captain.
			A Lieutenant (T.).
			One other Officer (Commander or Lieutenant).

The Boards are to be appointed by the Officer ordering the examination, and not more than one Officer of a Board may belong to the same ship as the candidate.

6. The examinations in Seamanship, and Navigation and Pilotage, are to commence on the second Monday in January, May and September, and are to consist of two written papers in Navigation (on the subjects laid down in the syllabus of the Examination), all the remainder being oral.

The examinations in Gunnery, Torpedo and Engineering are to commence on the second Monday in March, July and November, and are to consist of one written paper in Engineering (on the subjects laid down in the syllabus of the examination), all the remainder being oral. All written papers are to be taken on the Monday.

7. The papers in Navigation and Engineering will be set by the Commanding Officer of the Navigation School, Portsmouth, and an Officer selected by the Engineer-in-Chief respectively. These papers are to be sent under seal to the Director of Naval Education for printing three months before the date of the examination. The

printed question papers will be circulated to the Fleets in sealed packages, which are to be opened in the presence of the candidates assembled for the written part of the examinations.

8. The examinations are to be carried out on board such ships as shall be directed by the Officer ordering the examinations; and the Boards of Examiners are to be responsible for adequate supervision in the written parts.

9. All worked papers are to be marked by the Boards of Examiners, and sent to the Admiralty after marking. Marks in each subject, to a total of 1,000, including 100 for "former service" in each case, are to be assigned by the Boards in accordance with the schedules on the certificates.

10. The Boards are to award classes in each subject on the basis of 850 for a First Class, 650 for a Second Class, and 500 for a Third Class, except in Engineering, for which classes are to be awarded on the basis of 700 for a First Class, 550 for a Second Class, and 400 for a Third Class. The marks and classes awarded are to be reported to the Admiralty.

11. Candidates who fail to obtain a Third Class in either Seamanship or Navigation will be put back for four months, and will then be re-examined in the subject or subjects in which they have failed. They will not become Acting Sub-Lieutenants until they have passed, but failure on the first occasion will not entail any other penalty except that those who obtain first or second class certificates at the second trial will not count marks for those certificates towards accelerated promotion. A second failure will render an Officer liable to discharge from the Service. A Midshipman who is put back will still present himself with his term for examination in other subjects.

12. Acting Sub-Lieutenants who fail to obtain a Third Class in either Gunnery, Torpedo or Engineering will present themselves on the next occasion for examination in the subject or subjects in which they have failed. They will lose two months' time in respect of each of these three subjects in which they fail. A second failure will render an Officer liable to discharge from the Service.

13. On passing the examinations in Gunnery, Torpedo and Engineering, Acting Sub-Lieutenants will be confirmed in the rank of Sub-Lieutenant, with seniority according to the time awarded on passing out of Dartmouth College: *e.g.*, an Officer who is awarded two months' time will date his seniority as Sub-Lieutenant two years and ten months after being rated Midshipman; an Officer who is awarded one and a half months' time will serve half a month longer as Midshipman, and so on. The promotion of Midshipmen or Acting Sub-Lieutenants who have been deprived of time will be delayed by the amount of time lost.

14. The certificates (Form E. 190 revised) to be granted to Midshipmen and Acting Sub-Lieutenants on passing for the rank of Lieutenant are to be filled up in duplicate. One copy of Form E. 190 is to be forwarded to the Admiralty as soon as the results of the examination have been recorded in it; the duplicate is to be retained by the Officer.

15. Should a Midshipman or Acting Sub-Lieutenant be serving in a ship on detached service at the time he is due for examination, the written part in Navigation or Engineering, as the case may be, is to be carried out under the supervision of Officers of the ship. The worked papers are to be kept under seal by the Captain until such time as they can be handed over to the Board of Examiners to be marked. The oral part of the examination is to be carried out provisionally by Boards of Officers of the ship, appointed and presided over by the Captain.

The provisional examination is to be a "pass" examination only, no marks or classes being assigned. On passing provisionally in Seamanship and Navigation a Midshipman is to assume the rank and to receive the pay of an Acting Sub-Lieutenant. On passing provisionally in Gunnery, Torpedo and Engineering, an Acting Sub-Lieutenant is to receive the pay of a Sub-Lieutenant. An Officer passing provisionally is to be examined by properly constituted Boards at the earliest opportunity.

16. Before being granted a Lieutenant's commission every Officer must serve for 12 months at sea as a Sub-Lieutenant, six months of this time being spent on deck and six months in the Engine-Room Department. During this period he will receive

from the Captain of the ship in which he is serving certificates of efficiency to the following effect :

- (a) That he is fit to take charge of a Watch at sea as a Lieutenant and to perform efficiently the duties of that rank.
- (b) That he is fit to take charge of an Engine-Room Watch at sea and to perform efficiently the duties of a Junior Engineer Officer.

Duplicates of these certificates are to be forwarded immediately to the Admiralty.

If it should be impossible to grant either of these certificates to any Sub-Lieutenant on account of inefficiency a special report is to be made by letter.

17. These certificates are to be for professional proficiency only, and without them no Officer will be promoted. After obtaining certificates, Officers who may be qualified for accelerated promotion will be advanced according to the marks obtained in their examinations for the rank of Lieutenant.

Sub-Enclosure in Enclosure No. 25 in Third Report of Education Committee, dated 13th September, 1912.

SYLLABUSES OF EXAMINATIONS FOR THE RANK OF LIEUTENANT.

I.—SEAMANSHIP.

Requirements of the Examination—To determine whether the candidate has sufficient knowledge to take charge, as Officer of the Watch on deck, of a ship of war at sea, and to perform satisfactorily such duties as may be required of an Officer of the rank of Lieutenant.

In order to be so qualified he should have a knowledge of the following :

Rigging, &c.	<ul style="list-style-type: none"> Rigging and fittings. Hawsers, steel and hemp. Boats' falls, torpedo net fittings, &c. Sheers and derricks.
Anchor work	<ul style="list-style-type: none"> Anchor work in all its branches.
Rule of the Road.	
Officer of Watch	<ul style="list-style-type: none"> General duties at sea and in harbour. Handling the ship, effect of rudder and screws. Man overboard. Station keeping.
Organisation	<ul style="list-style-type: none"> Internal economy. Stations of Ship's Company for the various evolutions. Coaling ship. Preparing for sea and for harbour. Towing, forward and aft. Preparing for war. Target work.
Signals	<ul style="list-style-type: none"> Flags and their meanings. How to execute the various manoeuvring signals. Instructions for the conduct of a Fleet by day and night, and in a fog.

Certificate of Examination in Seamanship for the Rank of Lieutenant.

Mr. _____, Midshipman, having been examined in Seamanship by this Board for the rank of Lieutenant, and having produced the prescribed certificates, viz. :—

- (1) Qualification in handling boats;
- (2) Qualification in Morse and Semaphore;

is declared to have sufficient knowledge to take charge, as Officer of the Watch on deck, of a ship of war at sea, and to perform satisfactorily such duties as may be required of an Officer of the rank of Lieutenant, and is hereby awarded a Class Certificate.

Signature.

Rank.

Date

Full Marks. Marks Awarded.

Oral Examination:—

Rigging, &c.	-	-	-	-	75
Anchor work	-	-	-	-	125
Rule of Road	-	-	-	-	100
Officer of Watch duties	-	-	-	-	250
Organisation	-	-	-	-	150
Signals	-	-	-	-	150
Journal	-	-	-	-	50
Former service	-	-	-	-	100
Total	-	-	-	-	1,000

For a First Class, 850 marks.

,, Second Class, 650 marks.

,, Third Class, 500 marks.

II.—NAVIGATION AND PILOTAGE.

Requirements of the Examination.—To determine whether the candidate has sufficient knowledge to navigate one of H.M. Ships.

This knowledge should cover the following:—

Section I.—Reckoning and Observations.

One Paper.

Working out the dead reckoning of a ship.

Fixing a ship's position by plotting position lines.

Fixing a ship's position from two observations without plotting, using traverse and other tables.

Error of chronometer from two sets of absolute altitudes of the sun taken about the same bearing east and west, or from absolute altitudes of stars east and west.

Section II. —Navigation, Nautical Astronomy, Tides and Compasses.

One Paper.

Explanation of terms in ordinary use, the earth being regarded as a sphere.

Construction of Mercator's chart and table of meridional parts; Mercator's sailing.

Calculating time of meridian passage of a body.

Finding what bodies pass the meridian between two given times and which are suitable for observation.

- Approximate times of rising and setting of the sun and moon.
- Use of azimuth tables.
- Methods of obtaining the compass deviation.
- Latitude by meridian altitude, or altitude of Pole Star.
- The uses of a single position line. The choice of bodies for fixing by a cut.

Tides.—Elementary explanation of the causes of the tides and of the phases of the moon.

Calculation of times of high and low water at a given place by means of approximate rules.

Calculation of the depth of water at a certain place for any state of the tide :—

- (a) by means of tables ;
- (b) by means of harmonic motion diagram.

Compasses.—The magnetism of ships and its liability to change.

Semicircular, quadrantal and heeling error, and the principles of the mechanical correction.

Adjusting for B, C, D.

Swinging ship and analysing the deviation table, finding the approximate co-efficients.

Section III.—Oral Part.

Management and care of chronometers, stowage and safe distances from electrical appliances. Comparison and taking of times accurately. The value of the several methods of rating chronometers, and the means adopted for the elimination of errors.

General knowledge of the principal prevailing winds and currents of the globe, and of the principal routes adopted in making passages. The laws of revolving storms.

Knowledge of duties of Navigating Officer (*vide* King's Regulations, and "Notes bearing on the Navigation of H.M. Ships").

Practical use of charts and sailing directions, and of the various books, tables, &c., supplied with the chart boxes. Fixing positions by all methods, including the station pointer. Shaping courses and allowing for tides and currents.

Principles of Navigation in pilotage waters, use of leading marks, clearing marks, danger angles, and of lines of bearing to avoid danger. Anchoring a vessel in a pre-arranged position on a chart. Precautions when navigating in a fog, and method of utilising soundings.

General systems of lighting, buoyage, and fog signals in use on the coast of the British Islands.

Practical use and management of meteorological instruments, sounding machines, patent logs, and other navigating appliances, including sextant and its practical adjustments, and artificial horizon.

Knowledge of tidal laws. Practical use of Admiralty tide-tables and tidal atlases. Definitions and explanations of terms used in connection with tides.

The mooring board, Battenberg indicator, and Grant's manœuvring board.

Making an amendment to a chart.

Knowledge of the characteristics and the management of the various compasses and their appliances as supplied to H.M. Ships. The practical correction of a compass.

Certificate of Examination in Navigation and Pilotage for the Rank of Lieutenant.

Mr. _____, Midshipman, having been examined in Navigation and Pilotage by this Board for the rank of Lieutenant, and having produced his work book and a certificate showing that he has completed the prescribed list of observations, is

declared to have sufficient knowledge to navigate one of His Majesty's Ships, and is hereby awarded a **Class Certificate.**

Signature.	Rank.
Date	
Written Examination :—	Full Marks. Marks Awarded.
Section I. Reckoning and observations -	275 }
Section II. Navigation, nautical astronomy, tides and compasses - - -	425
	150 }
Oral Examination :—	
Section III.—	
Chronometers - - - - -	30 }
Winds and currents - - - - -	30
Use of charts and Sailing Directions -	45
Fixing positions and shaping courses -	80
Navigation in pilotage waters - -	50
General systems of coast lights and buoys - - - - -	40
Use of instruments, sounding machines, &c. - - - - -	40
Tides and tide tables - - - - -	50
Mooring board, Battenberg indicator and Grant's manœuvring board -	50
Compasses - - - - -	60
Former Service - - - - -	100
Total - - - - -	<u>1,000</u>

For a First Class, 850 marks.

„ Second Class, 650 marks.

“ Third Class, 500 marks.

III.—GUNNERY.

Requirements of the Examination.—To determine whether the candidate is qualified to take charge of a turret or other quarters, and to perform such gunnery duties as may be required of an Officer of the rank of Lieutenant.

In order to be so qualified he should have a knowledge of the following:—

Duties of Officer of Quarters. (See Notes I. and II.)—Drilling a gun's or turret's crew, including ability to instruct and command the guns' crews. (For this purpose guns' crews are to be closed up and the Officer's ability tested practically).

The training of gunlayers, sightsetters and other special numbers.

Adjustment and testing of sights (sea method).

Preparations for firing service, sub-calibre and aiming tube ammunition.

Adjustments of breech mechanisms and firing gear.

Gun circuits and how to test them. Miss-fires and their causes.

Procedure in case of accidents and failures.

Fire Control. (See Note I.)—Fire control arrangements by day and by night.

Practical use of the rangefinder, including ability to test and adjust it.

Practical use of all the fire control instruments in general use.

Hydraulics.—The general working of the mechanism of the more important hydraulic machinery of the selected turret (to be explained by means of rough sketches where necessary), omitting the details of working valves, interlocking gear, &c.

Maxim. (See Note II).—How to use a maxim gun and to deal with the various jams and failures; the general mechanism and working.

Ammunition.—The ammunition of the above selected guns, including fuzes, tubes, primers, &c., but no detailed descriptions or sketches required.

Stowage of magazines and shell rooms, and embarkation of ammunition.

How to use signal lights, rockets, port-fires and Very's lights.

Field Training. (See Note II).—How to take charge of men engaged in squad and company drill and in the rifle and firing exercise.

Officers' sword exercise.

Organisation. (See Note I).—General gunnery organisation of a ship, including preparation for war, preparation for action and night defence.

NOTE I.—The gun and turret to be drilled, the fire control arrangements by day and by night, and organisation are all to be those of the ship to which the candidate belongs at the time of his examination, provided he has been in that ship not less than six months; if not, those in one of the ships present with which he is more familiar may be selected by the Examining Board.

A pair-gun turret is to be selected if possible, and the hand-worked gun is to be the largest in the ship.

NOTE II.—The candidates may be examined in gun drill, company drill and maxim on any day within one month previous to the final examination, so that a convenient opportunity may be taken of drilling at the selected guns, landing with a company of men, and firing a maxim.

*This examination is to be carried out by two Lieutenants, one of whom must be a Lieutenant (G.), who will be detailed by the Senior Officer present, and the marks given are to be carried forward to the final examination.

Certificate of Examination in Gunnery for the Rank of Lieutenant.

Mr. _____, Acting Sub-Lieutenant, having been examined in Gunnery by this Board for the rank of Lieutenant, is declared to be qualified to take charge of a turret or other quarters, and to perform such gunnery duties as may be required of an Officer of the rank of Lieutenant.

Signature.

Rank.

Date _____.

					Full Marks.	Marks Awarded.
<i>Oral Examination:—</i>						
Duties of Officer of Quarters	-	-	-	-	350	{ drill 175 remainder 175
Fire Control	-	-	-	-	125	
Hydraulics	-	-	-	-	125	
Maxim	-	-	-	-	25	
Ammunition	-	-	-	-	50	
Field Training	-	-	-	-	100	
Organisation	-	-	-	-	125	
Former Service	-	-	-	-	100	
Total	-	-	-	-	1,000	

For a First Class, 850 marks.

„ Second Class, 650 marks.

„ Third Class, 500 marks.

IV.—TORPEDO.

Requirements of the Examination.—To determine whether the candidate is qualified in the use and care of torpedo weapons on board ship, and has a practical knowledge of electrical work and the electric appliances in use in the Service.

In order to be so qualified he should have a knowledge of the following:—

Whitehead.—Part I.:—

- (1) The use and power of the torpedo.
- (2) How to part a torpedo, and to make any simple adjustments to its mechanism, including gyroscopes, which may be necessary.
- (3) The care and maintenance of torpedoes.

Part II.:—

- (4) The adjustments required, and procedure for running torpedoes from ships and boats.
- (5) The pistol and net cutter; how fitted, tested, and stowed.
- (6) The working of the submerged and above-water tubes and dropping gear.
- (7) Duties of numbers and drill at the tubes and dropping gear (without detail).

Director:—

The use of the director—thorough knowledge.

Mining:—

- (1) The methods of clearing a mine-field.
- (2) The explosives in use in the Service, their stowage and testing.
- (3) The demolition of booms, wrecks and buildings.

Electrical Work:—

- (1) The cells and batteries commonly used in the Service; their action and characteristics; the general principles of the electric circuit.
- (2) Dynamos and motors—elementary knowledge.
- (3) Motor controllers and starters, sufficient knowledge only to work them efficiently; to replace cut-outs or overloads, knowing what is taking place when so doing.
- (4) The care and maintenance of electric machines, and simple tests of the same.
- (5) The use of switchboards and instruments. Distribution of electric power in ships; methods of testing for faults.
- (6) The use and control of searchlights and the method of adjustment—thorough knowledge.
- (7) How to use and adjust telephones and electric bells.
- (8) Gun circuits and night signals—thorough knowledge.

Certificate of Examination in Torpedo for the Rank of Lieutenant.

Mr. _____, Acting Sub-Lieutenant, having been examined in Torpedo by this Board for the rank of Lieutenant, is declared to be qualified in the use and care of torpedo weapons on board ship, and to have a practical knowledge of electrical work and the electric appliances in use in the Service, and is hereby awarded a _____ Class Certificate.

Signature.

Rank.

Date

Full Marks. Marks Awarded.

Oral Examination:—

Whitehead—Part I.	-	-	-	-	200
“ Part II.	-	-	-	-	200
Director	-	-	-	-	100
Mining	-	-	-	-	100
Electrical Work	-	-	-	-	300
Former Service	-	-	-	-	100
					<hr/>
Total	-	-	-	-	1,000

For a First Class, 850 marks.

“ Second Class, 650 marks.

“ Third Class, 500 marks.

V.—ENGINEERING.

Requirements of the Examination.—To determine whether the candidate has sufficient knowledge to take charge as Engineer Officer of the Watch in a ship of war at sea, and to perform satisfactorily such duties as may be required of a Junior Engineer Officer.

The examination will be mainly on the subjects named below, but may also include a few questions on the general theoretical principles of marine engineering which the Officers have studied during their training as Cadets, such as the most elementary thermodynamics of heat engines; the laws of gases; combustion of coal and oil; the use and knowledge of instruments for measuring power, density and other records; the nature of the resistance to propulsion; the relation of power to speed, revolutions of engines and coal consumption; and the immersion and stability of ships.

He should have a good knowledge of the following:—

- (a) *Organisation.*—The organisation of men for work in harbour, for steaming, coaling ship, and drill.
- (b) The use, construction, and action of the following parts of the machinery and structure of the ships in which the candidate has served—
 - The main propelling machinery and boilers.
 - The auxiliary machinery in the main machinery compartments.
 - Workshop machinery.
 - Evaporating and distilling plant.
 - The machinery and boilers of boats attached to ship.
 - Hydraulic pumping engines, tanks, pipes and valves.
 - Refrigerating, ice-making, and magazine cooling machinery.
 - Electric generating machinery.
 - Steering engines and gear.
 - Capstan engines and gear.
 - Air compressing machinery.
 - Boat hoists and coal hoists.
 - Any other steam, oil or gas driven machinery fitted.
 - Ventilation fans, trunks, pipes and valves.
 - Pipes, cocks and valves in connection with the pumping, draining and flooding systems.
 - Watertight doors and gear.
 - Instruments and gear for telegraphing signals in connection with the machinery.
 - The double bottoms, bulkheads, armour, framing, engine and boiler bearers, coal bunker arrangements, and structure of the ship generally.
- (c) Oil fuel burning and the conditions required for good stoking. The general properties, and methods of using various lubricating oils. Coaling gear and transporters. How to deal with minor and generally occurring mishaps in the Engine-Room Department.
- (d) *General.*—Care, maintenance and management of machinery and boilers when in and out of use. Ordinary examinations of machinery and boilers such as are usual on board ship, especially in regard to matters which require particular attention and in regard to the measurement of wear.
 - Ordinary repairs to machinery and boilers which are usually carried out by the staff of a ship in commission, and the time required for carrying out such repairs.
 - The methods of fitting spare parts, making adjustments of various parts of machinery, including a knowledge of the necessary working clearances allowed and gauges required for testing results.
 - The method of keeping the engine-room register, and a knowledge of the regulations and instructions affecting the machinery and boilers.

Certificate of Examination in Engineering for the Rank of Lieutenant.

This is to certify that Mr. _____, Acting Sub-Lieutenant, having been examined by this Board for the rank of Lieutenant, is declared to have sufficient knowledge to take charge as Engineer Officer of the Watch in a ship of war at sea under an experienced Engineer Officer, if necessary, and to perform satisfactorily

such duties as may be required of a Junior Engineer Officer. He is hereby awarded a First Class Certificate.

Signature.

Rank.

Date

Full Marks. Marks Awarded.

Engineering Note-Book	-	-	-	-	100
<i>Written Examination</i>	-	-	-	-	400
<i>Oral Examination</i> : -					
Main machinery	-	-	-	-	50
Boilers	-	-	-	-	50
Auxiliary machinery and steamboats	-	-	-	-	50
Duties of Engineer Officer of the Watch at sea and in harbour	-	-	-	-	90
Examinations, adjustments, repairs, and minor mishaps to machinery and boilers	-	-	-	-	160
Former Service	-	-	-	-	100
Total	-	-	-	-	1,000

For a First Class, 700 marks.

,, Second Class, 550 marks.

,, Third Class, 400 marks.

Enclosure No. 26 in *Third Report of Education Committee*, dated 13th September 1912.

EXTRACT from the ADDENDA of 1911 to the KING'S REGULATIONS and
ADMIRALTY INSTRUCTIONS of 1906.

Promotion Marks.

309A. At the discretion of their Lordships, promotion to the rank of Lieutenant will be made in accordance with the following scale, provided that the Officer's conduct has been satisfactory and subject to the provisions of Article 270, clause 3:—

A First Class in any subject counts two marks; a Second Class, one mark; and a Third Class, Nil.

Marks.

Promotion.

12	-	-	9 months from date of seniority as Sub-Lieutenant.
11	-	-	11 "
10	-	-	13 "
9	-	-	15 "
8	-	-	17 "
7	-	-	19 "
6	-	-	21 "
5	-	-	23 "

2. A Prize of Books or Instruments to the value of 10*l.* will be awarded to Officers who obtain First Class Certificates in all subjects.

*Enclosure No. 27 in Third Report of Education Committee, dated 13th September 1912.
C.W. 8608.*

Sir, Admiralty, 19th May 1912.
My Lords Commissioners of the Admiralty having had under their consideration the First Report of the Committee considering the training and education of Naval Officers of the Military Branch, desire me to inform you that they approve the recommendation of the Committee that, after September next, all voluntary subjects should cease to form part of the examinations for the rank of Lieutenant, and that the maximum number of marks laid down in Article 309A of the King's Regulations should be reduced from 12 to 10.

2. Notice of this change will be issued in the next Weekly Orders.

3. An announcement has also been made that further instructions will be issued as to the examinations in foreign languages for the money prizes awarded under Article 352A of the King's Regulations, and for the Ryder prize.

4. I am to request that my Lords may be furnished with copies of the evidence on which the Committee have based this Interim Report.

— I am, Sir,

your obedient Servant,

O. MURRAY.

Admiral Sir Reginald N. Custance,
K.C.B., K.C.M.G., C.V.O.,
Admiralty, S.W.

Enclosure No. 28 in *Third Report of Education Committee*, dated 13th September 1912.

EXTRACT from the KING'S REGULATIONS and ADMIRALTY INSTRUCTIONS, 1906,
as amended by ADDENDA of 1911.

QUALIFICATIONS FOR PROMOTION TO THE RANK OF LIEUTENANT.

270. To qualify a Midshipman for promotion to the rank of Lieutenant he must have completed three years and four months' service in that rank.

The qualifying service required will include the time awarded on leaving the Training Cruisers.

2. After completing the examinations prescribed in Chapter VII, Midshipmen will be promoted to Sub-Lieutenant as provided in Art. 308.

3. Before being granted a Lieutenant's Commission every Officer must serve for six months at sea as a Sub-Lieutenant. This service must take place immediately after he has passed all his examinations for the rank of Lieutenant. At the end of the six months he will receive from the Captain a Certificate of Efficiency, on the form provided in Form E. 190, to the effect that :

"He is fit to take charge of a Watch at sea as a Lieutenant, and to perform efficiently the duties of that rank."

A duplicate of the certificate is to be forwarded to the Admiralty.

If it should be impossible to grant the certificate to any Sub-Lieutenant on account of inefficiency a special report is to be made by letter.

This certificate is to be for professional proficiency only, and without it no Officer will be promoted.

After obtaining the certificate Officers who may be qualified for accelerated promotion will be advanced according to the marks obtained in their examinations for the rank of Lieutenant. (Art. **309A**.)

4. The Sub-Lieutenants' List will be governed by the numbers required to fill vacancies on the Lieutenants' List; the maximum period of service on the Sub-Lieutenants' List will be four years; any Sub-Lieutenants, not passed over for misconduct, reaching four years' seniority without sufficient vacancies having occurred on the Lieutenants' List to permit of their advancement, will be promoted as additional to the List of Lieutenants, and absorbed as vacancies arise.

5. A Midshipman who loses time through discharge to the shore on account of sickness, not attributable to his own fault, may be allowed by Admiralty Order to present himself for examination on the date on which he would have been entitled to do so had he not lost time as a consequence of such sickness. Any Midshipman whose case comes under this Order, and who wishes to avail himself of it, must apply through

his Captain for the necessary permission, in sufficient time to admit of the investigation of his case and receipt of reply before the date of the examination; but it is to be clearly understood that Officers who present themselves for examination will not be shown any special consideration should they fail to pass, or should they be classed lower than they might otherwise have anticipated.

Enclosure No. 29 in Third Report of Education Committee, dated 13th September 1912.

TRAINING OF OFFICERS ENTERED UNDER THE NEW SCHEME AFTER PASSING FOR THE RANK OF LIEUTENANT.

Circular Letter.

No. 6.

C.W. 17445.
1911

Admiralty, S.W., 5th February 1912.

THE LORDS COMMISSIONERS OF THE ADMIRALTY, having had under further consideration the instructions as to the Training of Officers entered under the new scheme promulgated in Circular Letter, No. 25,* of the 14th August 1911, C.W. 12006/1911, have decided to make the following amendments in paragraph 2 on the first page of that Circular:—

Delete the words:—

“During this period, Officers are to continue to spend a part of their time in doing duty in the Engine-Room Department, the time so spent to be not less than three weeks in every quarter, and, so far as possible, they are to perform the ordinary duties of a junior Engineer Officer.”

And substitute:—

“During this period, Officers are to serve for six consecutive months in the Engine-Room Department, where they are to perform the ordinary duties of a junior Engineer Officer, being replaced as regards their deck duties by a Senior Midshipman selected by the Captain from those serving on board, or, in ships where no Midshipmen are borne, by a Senior Midshipman lent for the purpose by the Commander-in-Chief. A report is to be forwarded in every case at the commencement, and again on the conclusion of this period of six months’ service in the Engine-Room Department.”

With reference to Circular Letter, No. 37,† of the 6th December 1911, C.W. 15846/1911, Their Lordships have decided that Midshipmen are not to be moved from the ships to which they are appointed by the Admiralty, except for the above purpose, or in special cases where the Commander-in-Chief considers it necessary.

By Command of Their Lordships,

W. GRAHAM GREENE.

To all Commanders-in-Chief,
Captains, Commanders,
and Commanding Officers
of H.M. Ships and Vessels
and Superintendents of
Dockyards at Home and
Abroad.

Enclosure No. 30 in Third Report of Education Committee, dated 13th September 1912.

DECK WATCH-KEEPING CERTIFICATE,

as proposed by the Committee.

(Authority:—King’s Regulations and Admiralty Instructions, Article ——.)

This is to certify that Sub-Lieutenant _____ is fit to take charge of a Watch at Sea as a Lieutenant, and to perform efficiently the duties of that rank.

Captain, H.M.S. “ ”

Date

A duplicate of the Watch-keeping Certificate is to be forwarded to the Admiralty.

ENGINE-ROOM WATCH-KEEPING CERTIFICATE,
as proposed by the Committee.

(Authority:—King's Regulations and Admiralty Instructions, Article).
 This is to certify that Sub-Lieutenant is fit

to take charge of an Engine-Room Watch at Sea, and to perform efficiently the duties
 of a Junior Engineer Officer.

Engineer

Approved—

Captain, H.M.S. “

Date

A duplicate of the Watch-keeping Certificate to be forwarded to the Admiralty.

Enclosure No. 31 in Third Report of Education Committee, dated 13th September 1912.

MIDSHIPMEN'S ENGINEERING CERTIFICATE.

Circular Letter.

No. 38.

C.W. 15286.

Admiralty, S.W., 8th December 1911.

My Lords Commissioners of the Admiralty have had under their consideration the provisions contained in Art. 299, Clause 1, Sub-clause *a*, V, of the King's Regulations and Admiralty Instructions, that, before being granted the certificate of having performed the duty of Engineer Officer of the Watch, Midshipmen should have had complete charge of a Watch and should have been responsible for it.

In view of the instructions contained in Art. 74, Clause 2, of the Steam Manual, to the effect that inexperienced Officers are not to be given any of the important duties in the Engine-Room except under the supervision of an experienced Engineer Officer, the Engineer Officer of the Ship has, in some cases, felt it to be inadvisable to place the Midshipmen in complete responsible charge of a Watch.

In order to meet such cases my Lords have decided that Midshipmen may be given certificates in the form prescribed overleaf—provided they are considered to be generally competent.

The accompanying amendment of the King's Regulations and Admiralty Instructions will be included in the 1912 reprint.

By Command of Their Lordships,

W. GRAHAM GREENE.

To all Commanders-in-Chief,
 Captains, Commanders,
 and Commanding Officers
 of H.M. Ships and Vessels
 at Home and Abroad.

Art. 299, Clause 1, Sub-clause *a*.

* * * * * *

V. A certificate signed by the Engineer Officer of the ship in which they have last served, to show that they have performed satisfactorily the duty of Engineer Officer of the Watch, under the supervision of an experienced Engineer Officer, if necessary, as provided in the Steam Manual, Art. 74, paragraph 2.

The Watch-keeping Certificate in Form E. 190 is to be added to accordingly, if necessary.

* * * * * *

COMMITTEE ON EDUCATION:

COMPARATIVE TABLE OF AGES AT DIFFERENT STAGES, OLD AND NEW SCHEMES.

Note.—The ages given above for the Engineering Branch are based on the Regulations of 1906; when the last entry of Engineer Cadets into Keyham was made, the ages for promotion have been gradually reduced to those shown above. Originally, about eight or nine years ago, the minimum age for promotion to the rank of Engineer Lieutenant was 24 and the maximum 27.

Enclosure No. 33 in *Third Report of Education Committee, dated 13th September 1912.*

EXTRACT from the KING'S REGULATIONS and ADMIRALTY INSTRUCTIONS, 1906, as amended by ADDENDA, 1911.

PILOTAGE AND NAVIGATING DUTIES.

313. Navigating Officers will be selected from those who volunteer for Navigating duties, preference being given to Officers who have obtained a First Class in Pilotage in the examination for the rank of Lieutenant, and good classes in the other subjects.

2. Selected candidates will go through a course of instruction in the Navigation School at Portsmouth. The Course of Instruction will last for 90 working days, part of the time being spent at sea and the remainder on shore. The subjects of instruction are given in Art. **313aA.**

3. Qualified candidates after leaving the School will be appointed to serve for a short period in the large Ships of the Channel, Mediterranean and Atlantic Fleets, in order that they may gain experience under the Navigating Officers in the work of a Fleet in regard to Navigating Duties.

4. At the end of the first three months of this period, and subsequently every succeeding three months, the Captain is to forward to the Admiralty with his covering remarks a report from the Navigating Officer on the qualifications of the candidate and his general suitability for Navigating duties. Upon these reports, and the result of the examination in the Navigation School, the permanent appointment of Officers for Navigating duties will depend.

5. The letter (N) will be prefixed (in the seniority columns of the Navy List) to the names of all Officers who have qualified for Navigating duties. This letter will be retained against their names only while they are actually employed, or are available for employment on those duties.

6. Lieutenants (N) will be placed on exactly the same footing as regards executive command and Ship's duty generally as Gunnery and Torpedo Lieutenants, and are not to be excused from any Ship's duties, except those which interfere with the special duties pertaining to them. They will be appointed and succeed to the position of First Lieutenant, if a vacancy occurs, in all Ships except Flagships where a Commander is borne, exactly in the same manner as any other specialist Officer; but in Ships where no Commander is borne they will not be appointed for First Lieutenant's duties, except in special circumstances.

7. Officers who perform Navigating duties as Lieutenant will not be required to continue those duties after promotion to the rank of Commander, unless they wish to do so. A Commander when borne for Navigating duties will not be appointed as the Executive Officer of the Ship.

8. Navigating Officers, while borne in Ships in Commission in reserve, will be given every opportunity of going through short courses of Gunnery and Torpedo, in order to keep themselves efficient in these duties.

9. The Examination in Pilotage for First Class Ships will be conducted by the Officers on the Staff of the Navigation School. The examination will be partly *révâ voce* and partly paper work. First and Second Class Certificates of proficiency only will be awarded. The examination syllabus is given in Art. **313aA.**

10. The examination will be compulsory for all Navigating Officers, who will be obliged to present themselves for examination within a reasonable time after completing three years sea service as Lieutenant (N). An Officer who fails to pass at the second trial will have his name erased from the list of Navigating Officers.

11. Before presenting himself for examination in Pilotage for First Class Ships, a Lieutenant (N) will be permitted to attend the School for one month's study. He will be allowed to make his own choice of the subjects he wishes to study, bearing in mind that the examination will include the subjects in which he was previously examined when in the School as a Sub-Lieutenant, and that an advanced knowledge of those subjects will be required.

12. Navigating Officers will also be granted facilities for attending the School for a month's course of study at periodical intervals during their subsequent career.

13. The letter (N†) will be prefixed (in the seniority columns of the Navy List) to the names of Commanders and Lieutenants who have passed the examination in Pilotage for First Class Ships. This letter will be retained against their names only while they are actually employed, or are available for employment, on Navigating duties.

14. Should it be probable that the exigencies of the Service will cause an Officer to be absent from England at the date he will complete the three years' service required to render him eligible to pass for First Class Ships, he may be examined before leaving England, provided that he has completed two and a half years of such service; but he will not be eligible for appointment to Navigating charge of a First Class Ship, nor be entitled to the corresponding increase in Navigating Allowance until he has completed the full period of three years' qualifying service.

15. Provisional Examinations may also be held in the following circumstances: --

(a) A Lieutenant (whilst serving as a Navigating Officer on a Foreign Station), if he happen to be at sea or in a Ship on detached service on the date he completes the service required to qualify him to present himself for Examination for First Class Ships, may apply to his Captain for a Provisional Certificate in Pilotage for First Class Ships, and such Certificate is to be given at the discretion of the Captain, based on his knowledge of the capabilities of the applicant as a Navigating Officer, and will hold good until the Ship meets the Commander-in-Chief or Senior Officer. The Officer must then apply for a passing day to be fixed, and a Board of Examining Officers is to be appointed, consisting of three Officers qualified for First Class Ships (or two if only that number be present) and presided over by a Captain.

Should the Officer pass the examination, the Examiners will award him a Provisional Certificate of Qualification for First Class Ships, and such Certificate will entitle him to increase of allowance from the date of the Certificate granted by his Captain, but dependent on his passing the regular examination on returning to England. If, after his arrival in England, an Officer neglects to take an opportunity of passing the regular examination, and, before passing, receives another appointment for Navigating duties, he will not be allowed to receive the increased allowance. Should the Officer eventually fail to pass, he will be called upon to refund the amount of the increased allowance which he has received since passing the Provisional Examination.

(b) A Lieutenant who completes the service required to qualify him to present himself for examination for First Class Ships whilst serving as a Navigating Officer on a Home Station, may apply to his Captain for, and may be granted, a Provisional Certificate as provided for in Sub-Clause (a) of this Clause. The Intermediate Examination by a Board of Officers will not be required in such cases, but the Officer must present himself at the next general examination on board the Navigation School Ship, when, if he pass, he will become entitled to the authorised increase of allowance from the date of his Provisional Certificate. Should, however, an Officer be prevented by duty or sickness from presenting himself on the first examination day, he must produce a certificate from his Captain to that effect when he does present himself, as otherwise he will not be entitled to the increase of allowance until the date of passing.

On an Officer passing provisionally, a notation is to be made against his name on the Ship's Books, stating the date of such passing. No payment at the increased rate is to be made until he has passed the final examination on board the Navigation School Ship.

16. All Provisional Certificates are to be granted in duplicate, and are to be attached to the final Passing Certificates, upon which the dates of the Captain's Certificate and of the Provisional Passing are to be noted.

Enclosure No. 34 in Third Report of Education Committee, dated 13th September 1912.

EXTRACT from the KING'S REGULATIONS and ADMIRALTY INSTRUCTIONS, 1906.

GUNNERY AND TORPEDO DUTIES.

866. Lieutenants desirous of qualifying as Gunnery and Torpedo Lieutenants are to apply through the Captains of the ships in which they are serving, or, if on half-pay to the Secretary of the Admiralty direct, sending copies of their certificates or of other testimonials they may wish to produce. All applications should reach the Admiralty by 1st December each year.

2. Officers selected to qualify must have previously served one year at sea as Lieutenant.

3. The final examination for Gunnery and Torpedo Lieutenants will be in March, after passing which, unless otherwise required, they will assist in the Gunnery and Torpedo instruction of the Schools.

4. Should it be found, during any part of the course of instruction, that a Lieutenant is not likely to prove efficient as a Gunnery or Torpedo Officer, his name is to be submitted to the Admiralty with a view to his removal from the books of the "Excellent" or "Vernon."

5. Officers qualifying within the prescribed period and Officers going through a short course in Gunnery or Torpedo will be allowed to count the whole time they are borne in the "Excellent" or "Vernon" for instruction as time on Full Pay.

Officers who fail to qualify, and Short Course Officers who fail to obtain a certificate, or of their own accord leave before the completion of the course in either Gunnery or Torpedo, will count the time as Half Pay time.

6. Officers who may be removed on account of misconduct or inefficiency are only to count time as Half Pay time.

7. The cases of Officers leaving on account of illness will be specially considered.

8. The qualifying course for Lieutenants (G†) and (T†) is laid down in "The Courses of Instruction in Gunnery and Torpedo."

9. Four short courses of instruction in Gunnery and Torpedo, each of 40 working days, will be held annually for Lieutenants R.N., and Officers R.M.A., R.I.M., and R.N.R. Officers should state, when applying to join these courses, to which Gunnery or Torpedo School they would prefer to be attached, and they will be appointed on the dates published in the official list of Courses.

10. Officers appointed for Gunnery or Torpedo duties to ships not carrying a Gunnery or Torpedo Lieutenant will receive 1s. a day additional pay.

The Captains of all sea-going ships are to report annually the names of any Lieutenant serving under their command whom they would recommend for these duties.

Enclosure No. 35 in Third Report of Education Committee, dated 13th September 1912.

TRAINING OF OFFICERS ENTERED UNDER THE NEW SCHEME AFTER PASSING FOR THE RANK OF LIEUTENANT, AND APPOINTMENT OF OFFICERS TO ROYAL MARINES.

Circular Letter.

No. 25.

C.W. 12006.
1911

Admiralty, S.W., 14th August 1911.

In continuation of Circular Letter of 1st May 1908, No. 51*, My Lords Commissioners of the Admiralty have had under consideration the further training of Officers entered under the New Scheme after passing for the rank of Lieutenant, with special reference to service in the Engineer and Marine Branches, and have approved of the issue of the following instructions for the information and guidance of all concerned.

I.—OFFICERS IN GENERAL.

After passing all their examinations for the rank of Lieutenant, Officers will be given seniority as Sub-Lieutenant in accordance with the provisions of Article 308 of the King's Regulations (Addenda). They will be required to serve at sea for not less than two years as Commissioned Officer and for at least one year as Lieutenant. During this period Officers are to continue to spend a part of their time in doing duty in the Engine-Room Department, the time so spent to be not less than three weeks in every quarter, and, so far as possible, they are to perform the ordinary duties of a junior Engineer Officer.

Before being eligible to commence specialisation in Gunnery, Torpedo, or Engineering, a Lieutenant must have served in that rank for at least one year at sea and must have completed at least two years from the date of his commission as Sub-Lieutenant. Officers may volunteer to specialise one year after attaining the rank of Sub-Lieutenant, but they will not as a rule be definitely selected until shortly before the specialist course commences.

Officers may apply to specialise in more than one class of duties, indicating the order of their preference, so that in the event of there not being vacancies in one class, they may still be selected for one of the others.

Officers desiring to qualify for service with the Royal Marines may volunteer for such duty on reaching the rank of Sub-Lieutenant, and if selected they will be required to serve at sea for eight months in the rank of Sub-Lieutenant and to obtain the Watch-keeping Certificate referred to in Article 270, Clause 3,* of the King's Regulations, before being eligible to commence military training on shore.

II.—ENGINEERING BRANCH.

The specialist course of instruction to qualify an Officer in Engineering will consist, as for other specialists, of a scientific course at the Royal Naval College, Greenwich, lasting for two terms or approximately six months, followed by a practical course at a Dockyard extending over a period of about one year. This latter course will include practical and other work in Engineering and also practice in testing and experimenting.

On completion of the course and after passing the required examination, these Officers will become Lieutenants (E), and will be qualified to perform the duties of a junior Engineer Officer afloat. Being members of the Military Branch, they will conform to all the regulations applicable to, and receive the pay, of that Branch.

When appointed for Engineering duties, they will receive extra pay, the rate of which is appended, in the same manner and under the same conditions as other specialist Officers. A Lieutenant (E) will not, however, be appointed for First Lieutenant's duties, nor will he draw pay for those duties.

They will be on the same footing as other specialist Officers in regard to promotion to Commander, and will be required to pass the same examination for promotion (Article 269, Clause 2, King's Regulations and Admiralty Instructions).† When promoted, the position of the Commander (E) will be in all respects similar to that of a Commander (N) as regards appointment, employment, and eligibility for promotion to Captain.

From among those who have qualified for Lieutenant (E) a selection will be made of a limited number of Officers who will devote themselves to Engineering, with a view to qualifying for the higher technical and administrative Engineering appointments at the Admiralty and in the Dockyards. These Officers will undergo a further two years' course of scientific training at the Royal Naval College, Greenwich, proceeding there immediately after qualifying as Lieutenant (E). The instruction will be on the same lines as that now given to Engineer Officers during their second and third sessions at the College, with such modifications as may be found necessary.

Lieutenants (E) who successfully pass the examination at the end of this two years' course will be designated Lieutenants (E†) and will proceed to sea for a period of service afloat, after which they will be available either to take up special duty on shore, if their services are at once required, or to continue to perform the duties of an Engineer Officer at sea until they are needed for a shore appointment

They will receive a higher rate of allowance for Engineering duties as appended.

Lieutenants (E†) will not be required to pass the examination for Commander as a condition of promotion to Commander (E†). In special circumstances they may be permitted to drop Engineering and to revert to deck duties on promotion to Commander, provided they have passed the prescribed examination for Commander.

Commanders (E†) will be eligible to serve in an Engineering capacity at sea and in special Engineering appointments on shore. They will be eligible for promotion by selection to Captain (E†), and Captains (E†) will be eligible for promotion to Flag rank, in the same manner as Commanders and Captains respectively, but they will not, when so promoted, take command of sea-going ships or of Fleets.

The rates of specialist allowances for Officers qualified in Engineering will be as follows :—

				<i>s.</i>	<i>d.</i>
Lieutenant (E)	-	-	-	1	0 a day.
(E†)	-	-	-	5	0 "
Commander (E)	-	-	-	5	0 "
(E†)	-	-	-	7	0 "
Captain (E†)	-	-	-	7	0 in addition to Command Money at the rate of 5s. a day.

Charge Pay, Senior Engineer's Allowance and Flag Allowance will be paid as at present.

To all Commanders-in-Chief,
Captains, Commanders,
and Commanding Officers
of H.M. Ships and Vessels
at Home and Abroad.

Enclosure No. 36 in *Third Report of Education Committee*, dated 13th September 1912.

REGULATIONS AS TO SPECIALISING.

As proposed by the Committee.

General.

Officers wishing to specialise in Navigation or Engineering will be allowed to volunteer at any time after they have served one year at sea in the rank of Sub-Lieutenant, provided they have obtained the two Watch-keeping Certificates for Deck and Engine-Room duties. Those wishing to specialise in Gunnery or Torpedo will be allowed to volunteer at any time after attaining the rank of Lieutenant.

2. Officers may apply to specialise in more than one of the above branches, and may indicate the order of their preference, so that in the event of there not being vacancies in one branch, they may be selected for another.

3. Applications are to be made through the Captains of the ships in which the Officers are serving, (or if on half pay to the Secretary of the Admiralty direct), and are to be accompanied by copies of their certificates, and any other testimonials that they may wish to produce.

4. As far as possible, Officers who have been selected will be informed six months before the commencement of the course, whichever it may be.

Navigation.

5. Officers selected to specialise in Navigation must have served not less than one year at sea as Sub-lieutenant. Preference will be given to those who have obtained First Class Certificates in Navigation and Pilotage in the examination for the rank of Lieutenant and good classes in the other subjects.

6. They will undergo a course of instruction of 99 working days in the Navigation School at Portsmouth, part of this time being spent at sea and the remainder on shore. Two courses will be held annually.

7. On completion of the course, and after passing the required examination, these Officers will be appointed to serve for a short period in large ships as assistants to the Navigating Officer, in order to gain experience in the work of a Fleet in regard to Navigating duties.

8. At the end of the first three months of this period, and subsequently every succeeding three months, the Captain is to forward to the Admiralty with his covering remarks a report from the Navigating Officer on the qualifications of the candidate and his general suitability for Navigating duties. Upon these reports, and the result of the examination in the Navigation School, the permanent appointment of Officers for Navigating duties will depend.

9. The letter (N) will be prefixed (in the seniority columns of the Navy List) to the names of all Officers who have qualified for Navigating duties. This letter will be retained against their names only while they are actually employed, or are available for employment, on those duties.

10. Lieutenants (N) will be placed on exactly the same footing as regards executive command and Ship's duty generally as Gunnery and Torpedo Lieutenants, and are not to be excused from any Ship's duties, except those which interfere with the special duties pertaining to them. They will be appointed and succeed to the position of First Lieutenant, if a vacancy occurs, in all Ships, except Flagships, where a Commander is borne, exactly in the same manner as any other specialist Officer; but in Ships where no Commander is borne they will not be appointed for First Lieutenant's duties, except in special circumstances.

11. Officers who perform Navigating duties as Lieutenant will not be required to continue those duties after promotion to the rank of Commander, unless they wish to do so. A Commander when borne for Navigating duties will not be appointed as the Executive Officer of the Ship.

12. Navigating Officers, while borne in Ships with reduced nucleus crews, will be given every opportunity of going through short courses of Gunnery and Torpedo, in order to keep themselves efficient in these duties.

13. The Examination in Pilotage for First Class Ships will be conducted by the Officers on the Staff of the Navigation School. The examination will be partly *virtu rote* and partly paper work. First and Second Class Certificates of proficiency only will be awarded. The examination syllabus is given in Article **313aA**.

14. The examination will be compulsory for all Navigating Officers, who will be obliged to present themselves for examination within a reasonable time after completing three years' sea service as Lieutenant (N).

15. Before presenting himself for examination in Pilotage for First Class Ships, a Lieutenant (N) will be permitted to attend the School for one month's study. He will be allowed to make his own choice of the subjects he wishes to study, bearing in mind that the examination will include the subjects in which he was previously examined when in the School, and that an advanced knowledge of those subjects will be required.

16. Navigating Officers will also be granted facilities for attending the School for a month's course of study at periodical intervals during their subsequent career.

17. The letter (N†) will be prefixed (in the seniority columns of the Navy List) to the names of Commanders and Lieutenants who have passed the examination in Pilotage for First Class Ships. This letter will be retained against their names only while they are actually employed, or are available for employment, on Navigating duties.

18. Should it be probable that the exigencies of the Service will cause an Officer to be absent from England at the date he will complete the three years' service required to render him eligible to pass for First Class Ships, he may be examined before leaving England, provided that he has completed two and a half years of such service; but he will not be eligible for appointment to Navigating charge of a First Class Ship, nor be entitled to the corresponding increase in Navigating Allowance until he has completed the full period of three years' qualifying service.

19. Provisional Examinations may also be held in the following circumstances:--

(a) A Lieutenant (whilst serving as a Navigating Officer on a Foreign Station), if he happen to be at sea or in a Ship on detached service on the date he completes the service required to qualify him to present himself for Examination for First Class Ships, may apply to his Captain for a Provisional Certificate in Pilotage for First Class Ships, and such Certificate is to be given at the discretion of the Captain, based on his

knowledge of the capabilities of the applicant as a Navigating Officer, and will hold good until the Ship meets the Commander-in-Chief or Senior Officer. The Officer must then apply for a passing day to be fixed, and a Board of Examining Officers is to be appointed, consisting of three Officers qualified for First Class Ships (or two if only that number be present) and presided over by a Captain.

Should the Officer pass the examination, the Examiners will award him a Provisional Certificate of Qualification for First Class Ships, and such Certificate will entitle him to increase of allowance from the date of the Certificate granted by his Captain, but dependent on his passing the regular examination on returning to England. If, after his arrival in England, an Officer neglects to take an opportunity of passing the regular examination, and, before passing, receives another appointment for Navigating duties, he will not be allowed to receive the increased allowance. Should the Officer eventually fail to pass, he will be called upon to refund the amount of the increased allowance which he has received since passing the Provisional Examination.

(b) A Lieutenant who completes the service required to qualify him to present himself for examination for First Class Ships whilst serving as a Navigating Officer on a Home Station, may apply to his Captain for, and may be granted, a Provisional Certificate as provided for in Sub-Clause (a) of this Clause. The Intermediate Examination by a Board of Officers will not be required in such cases, but the Officer must present himself at the next general examination on board the Navigation School Ship, when, if he pass, he will become entitled to the authorised increase of allowance from the date of his Provisional Certificate. Should, however, an Officer be prevented, by duty or sickness, from presenting himself on the first examination day, he must produce a Certificate from his Captain to that effect when he does present himself, as otherwise he will not be entitled to the increase of allowance until the date of passing.

On an Officer passing provisionally, a notation is to be made against his name on the Ship's Books, stating the date of such passing. No payment at the increased rate is to be made until he has passed the final examination on board the Navigation School Ship.

20. All Provisional Certificates are to be granted in duplicate, and are to be attached to the final Passing Certificates, upon which the dates of the Captain's Certificate and of the Provisional Passing are to be noted.

Gunnery and Torpedo.

21. Officers selected to specialise must have previously served not less than one year at sea as Lieutenant in charge of a Watch in a sea-going Ship, preference being given to those who have obtained First Class Certificates in Gunnery and Torpedo respectively and good classes in the other subjects.

22. The instruction necessary to qualify an Officer in Gunnery or Torpedo will consist of a course of study lasting six months at the Royal Naval College, Greenwich, followed by a practical course lasting eight months, including leave, in the "Excellent" and "Vernon" respectively.

23. The courses at Greenwich are to be so arranged as to serve as a preparation for the practical courses at the Gunnery and Torpedo Schools, and the whole training at both places is to be strictly limited to what is essential for Lieutenants (G) and (T) in sea-going Ships.

24. On completion of these courses, and after passing the required examination, these Officers will become Lieutenants (G) and (T) respectively. There will be two classes of Lieutenants (G) and (T) differentiated only as regards pay. To become a First Class Lieutenant (G) or (T) it will be necessary for an Officer to obtain First Class Certificates in the Examinations held on completing the Greenwich course and the course in the Torpedo or Gunnery School respectively.

25. A limited number of Lieutenants (G) and (T), First Class, who may volunteer will be selected to undergo an advanced course of six months' study at the Royal Naval College, Greenwich. No examination will be held at the end of this course.

26. Should it be found, during any part of the course of instruction, that a Lieutenant is not likely to prove efficient as a Gunnery or Torpedo Officer, his name is to be submitted to the Admiralty with a view to his removal from the books of the "Excellent" or "Vernon."

27. Officers qualifying within the prescribed period will be allowed to count the whole time they are borne in the "Excellent" or "Vernon" for instruction as time on Full Pay.

Officers who fail to qualify, or of their own accord leave before the completion of the course in either Gunnery or Torpedo, will count the time as Half Pay time.

28. Officers who may be removed on account of misconduct or inefficiency are only to count time as Half Pay time.

29. The cases of Officers leaving on account of illness will be specially considered.

Engineering.

30. An Officer applying to specialise in Engineering must obtain a recommendation from the Captain and Engineer Officer of the Ship in which he obtained his Engine-Room Watch-keeping Certificate.

31. Every Officer must have completed at least two years as a commissioned Officer in a sea-going ship before being eligible to specialise.

32. The instruction necessary to qualify an Officer in Engineering will consist of a course of study lasting six months at the Royal Naval College, Greenwich, followed by a practical course lasting approximately one year, including leave, at Keyham College, Devonport.

33. On completion of these courses, and after passing the required examination, these Officers will become Lieutenants (E). There will be two classes of Lieutenants (E) differentiated only as regards pay. To become a First Class Lieutenant (E), it will be necessary for an Officer to obtain First Class Certificates in the Examinations held on completing the Greenwich and Keyham courses.

34. Lieutenants (E) when appointed for Engineering duties will receive extra pay, in the same manner and under the same conditions as other specialist Officers. They will also receive Charge Pay, Senior Engineer's Allowance and Flag Allowance, when so entitled. Lieutenants (E) will not be appointed for First Lieutenant's duties, however, nor will they draw pay for those duties. They will be on the same footing as other specialist Officers in regard to promotion to Commander. When promoted, the position of the Commander (E) will be in all respects similar to that of a Commander (N) as regards appointment, employment, and eligibility for promotion to Captain.

35. Officers qualifying within the prescribed period will be allowed to count the whole time they are borne for instruction as time on Full Pay.

Officers who fail to qualify, or of their own accord leave before the completion of the course in engineering will count the time as Half Pay time.

36. Officers who may be removed on account of misconduct or inefficiency are only to count time as Half Pay time.

37. The cases of Officers leaving on account of illness will be specially considered.

Sub-Enclosure in Enclosure No. 36 in Report of Education Committee, dated 13th September 1912.

PROPOSED SCALE of ALLOWANCES to SPECIALIST OFFICERS in addition to FULL PAY.

	Allowances to Lieutenant in addition to Full Pay.	Year of 365 Days.	One Day.
For Navigating duties			
" "	if of five years' seniority	£ 15 12 6	2 6
" "	if passed for First Class Ships for Pilotage without regard to seniority.	54 15 0	3 0
" "	when appointed to a ship bearing a flag or broad pendant in addition to Navigating Allowance, but subject to any conditions that the Admiralty may lay down.	73 0 0	4 0
For Gunnery duties :—			
First Class	—	73 0 0	1 0
Second Class	—	54 15 0	3 0
For Torpedo duties :—			
First Class	—	73 0 0	4 0
Second Class	—	54 15 0	3 0
For Engineering duties :—			
First Class	—	91 5 0	5 0
Second Class	—	73 0 0	1 0
Allowance to Commander (E) in addition to Full Pay	—	91 5 0	5 0

Officers for Engineering duties will also be paid Charge Pay, Senior Engineer's Allowance, and Flag Allowance as at present.

Enclosure No. 37 in Third Report of Education Committee, dated 13th September 1912.

SPECIALISATION OF OFFICERS IN ENGINEERING.

(C.W. 8594. 24.5.12.)

With reference to King's Regulations, Article **312a**, it has been decided as a temporary measure to suspend the regulation as to the length of service necessary to render Officers eligible to specialise in Engineering.

As the first course to qualify for specialisation will commence in October 1913, and at that date there will not be a sufficient number of Lieutenants eligible by service, Officers desirous of qualifying in Engineering will, for the present, be considered for selection provided they have performed their six months' training in the engine-room, as required by Circular Letter No. 6, of the 5th February 1912, and have obtained their deck watch-keeping certificate.

Lieutenants and Sub-Lieutenants who entered as Cadets in September 1903 and January 1904 may now send in their applications to specialise in Engineering with a view to a selection being made for the first course.

Enclosure No. 38 in Third Report of Education Committee, dated 13th September 1912.

EXTRACT from the ADDENDA of 1911 to the KING'S REGULATIONS and ADMIRALTY INSTRUCTIONS, 1906. EXAMINATION FOR THE RANK OF COMMANDER.

Article **269.**

* * * * *

2. Lieutenants who have passed as Cadets into the "Britannia" or other training establishment in or after January 1903, will be required, at any time after attaining five years' seniority, to pass a qualifying examination for promotion to the rank of Commander, in the following subjects:—

Court-Martial Procedure.

International Law.

Knowledge of British and Foreign Warships, Guns, Torpedoes, &c.

Naval History.

Signals.

Strategy.

Tactics and Battle Formations.

* * * * *

Enclosure No. 39 in Third Report of Education Committee, dated 13th September 1912.

ORGANISATION AND TRAINING OF WAR STAFF.

Circular Letter.

No. 10.

C. W.

Admiralty, S.W., 11th March 1912.

The Lords Commissioners of the Admiralty having decided to establish a War Staff for the Navy, the following particulars are promulgated for information and guidance.

The War Staff is designed to provide a body of officers so trained as to qualify them for employment at the Admiralty, on the Staffs of Commanders-in-Chief or other Flag Officers, in Squadrons, Torpedo or submarine flotillas, and at Naval bases, in such numbers as their Lordships may from time to time decide.

In addition to the Senior Officers now holding War Staff appointments, the personnel of the War Staff will at the outset comprise Naval and Marine Officers of the rank, or relative rank, of Commander and Lieutenant, and include representatives of every specialist branch; it will be in numbers sufficient to afford an ample field for selection for the various appointments and to permit of that interchange of staff and general service afloat and ashore which the experience of the past has shown to be indispensable to the efficiency of the Naval Service.

Hitherto no special rules have governed the system of choosing officers for posts at the Admiralty or upon the Staffs of Commanders-in-Chief; they have

selected upon the best general appreciation possible of their personal qualities; in future, membership of the War Staff will be a primary condition. At first such membership will not be confined to officers who may have undergone the special courses of training now instituted. Certain appointments must at once be filled by officers of rank and seniority who have not had the opportunity of qualifying under the new system.

A limited number of officers with suitable qualifications will be selected to form the nucleus of the War Staff, and their names and appointments will be duly notified. All officers so selected will not, however, receive Staff appointments, and it will take time before there are suitable vacancies which can be filled by officers placed on the Staff.

Lieutenants of six years' seniority and upwards may apply to join the War Staff, and will be selected according to the reports upon their qualifications.

The qualifying course of instruction at the War College will last a year and will comprise two sessions divided by service in the Summer manoeuvres. Officers who complete this course in a satisfactory manner will be eligible for Staff Employment as vacancies occur. War Staff Officers may be invited to attend a superior War College course at a later period of their service.

In the meanwhile, whether they hold War Staff appointments or not, they will maintain a systematised correspondence with the President of the War College and his assistants on general questions of professional interest or staff duties, in order that their contact with the War College may be unbroken. The President of the War College will at the proper time issue full directions regarding this correspondence, which will in all cases pass through the various Commanders-in-Chief.

Membership of the War Staff implies no right to Staff appointments, and War Staff Officers will not be continuously employed on Staff duty. On the contrary, it is essential that periods of sea service in which these officers will perform the ordinary duties of their rank should alternate in due proportion with Staff employment to ensure that they remain efficient sea-going officers.

It has been explained clearly in the memorandum of the First Lord announcing the formation of the War Staff, that practical seamanship, professional knowledge, and personal qualities of command, will, as heretofore, continue to govern the advancement of all officers in the service.

The courses at the War College will be adapted both to Lieutenants qualifying for Staff appointments and to Senior Officers who have already qualified for, or who have been placed upon, the War Staff as original members. The War College at Portsmouth will be enlarged and special courses be instituted so far as may be necessary for these purposes.

The President of the War College will prescribe the scope and character of the various courses, and the necessary information regarding them will be imparted to those concerned by their Lordships.

Twelve officers of the rank of Lieutenant of six years' seniority and upwards will be selected to join the present War College session, commencing on March 27th, 1912.

Three officers of the Royal Marines will also be selected—from officers of the rank of Captain, R.M.A. or R.M.L.I., who have been at least one year in command of a detachment embarked.

Officers not selected to undergo the courses in 1912 will still be eligible for future consideration.

Officers, when employed in War Staff appointments, will receive an allowance of 5s. a day if of Commander's rank, and 4s. a day if of Lieutenant's rank, in which will be absorbed any specialist allowance already payable.

Officers eligible for special allowances for Gunnery, Torpedo, or other qualifications will draw those allowances while undergoing the courses.

By command of Their Lordships,

W. GRAHAM GREENE.

To all Commanders-in-Chief,
Captains, Commanders, and
Commanding Officers of
H.M. Ships and Vessels at
Home and Abroad.

Enclosure No. 40 in *Third Report of Education Committee*, dated 13th September 1912.

NUMBERS OF NAVAL INSTRUCTORS—AUGUST 1912.

Numbers on Active List:—

Naval instructors	-	-	-	-	-	-	-	32
Chaplains and Naval Instructors	-	-	-	-	-	-	-	28
								<hr/>
								60

	Naval Instructors.	Chaplain- and Naval Instructors.	Total.
<i>Number serving at Sea:</i> —			
In Training Cruisers	4	2	6
With Midshipmen (including the Rev. W. Hall, who will be lent to Australia from September 1912).	14	13	27
Absent sick	—	1	1
	18	16	34
<i>Number serving on Shore:</i> —			
In Training Establishments, D.N.E.'s office, &c.	12	11*	23
Lent to Colonial and Foreign Governments	2	—	2
	14	11	25
<i>On permanent Half Pay</i>	—	1	1
Total	32	28	60

* Of these eleven, nine are serving in the single capacity of Chaplain at Dockyards, Marine Divisions, &c.

Military—continued.

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